NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: AEM 508

COURSE TITLE: TECHNOLOGICAL AND SOCIAL CHANGE IN AGRICULTURE

AEM 508
TECHNOLOGICAL AND SOCIAL CHANGE IN AGRICULTURE

Course Team	Dr. A.E. Adekoya (Course Developer/Writer) - University of Ibadan
	Prof. Isaac Butswart (Course Editor) – NOUN
	Dr. N.E. Mundi (Programme Leader) – NOUN
	Mr. Samuel Awolumate (Course Coordinator) - NOUN

NATIONAL OPEN UNIVERSITY OF NIGERIA

CONTENTS   PAGE

INTRODUCTION

Technological and Social Change in Agriculture (AEM 508) is a course available for students of agriculture at the 500 level of the National Open University of Nigeria (NOUN). It seeks to lay the groundwork for an understanding of the relationship between technology and the equilibrium of the social system in the development of Agriculture knowledge systems.

COURSE AIM

The aim of this course is to familiarise you with the subject matter which is dealt with herein and which you are expected to know after reading through this course material.

COURSE OBJECTIVES

The major objectives of this course are to ensure that on completion of this course you should be able to:

- define the term 'technology'
- explain what indigenous technology is and its effects on agricultural development
- discuss how technology affects social systems
- specify the different schools of thought on the concept of social change
- itemise the factors to contend with as a change agent
- develop competencies on efficient and effective technology transfer process
- state reasons for the failure of technology transfer in local communities
- discuss the appropriate strategy to employ as an extension agent in introducing new technology in local communities
- outline the significance of improved technology to Nigerian agricultural development
- explain the promotion of technological change and agricultural transformation
- outline the principles of agricultural extension
- mention and underline the process of mechanising Nigerian agriculture.

WORKING THROUGH THIS COURSE

To complete this course, you are advised to read the study units, recommended books and other materials provided by NOUN. Each unit contains Self Assessment Exercise, and at some point in the course you are required to submit assignments for assessment. At the end of the course there is a final examination. The course should take you about 12 weeks to complete. You will find all the components of the course listed below. You need to make out time for each unit in order to complete the course successfully and on time.

COURSE MATERIALS

The major components of the course are:

1. Course Guide
2. Study Units
3. Textbooks
4. Assignment File
5. Presentation Schedule.

STUDY UNITS

In this course there are four (4) modules divided into thirteen (13) study units as follows:

Module 1

Unit 1   Understanding Technology and the Concept Of Social Change
Unit 2   Understanding Technological Change
Unit 3   Basic Social Concepts

Module 2

Unit 1   Technological Change and Societies
Unit 2   General Principles in Introducing Technological Change in Nigerian Agricultural Development
Unit 3   Factors to be considered in Introducing a Technology into a Community

Module 3

Unit 1   Influence of Technological Changes in Nigerian Agricultural Development
Unit 2   Agricultural Extension as a Source of Technological Change
Unit 3   Principles of Agricultural Extension
Unit 4   Role of Agricultural Extension in Agricultural Development

Module 4

Unit 1   Functions of Change Agents in Technology Transfer
Unit 2   Ethical Considerations in Introducing Technological Changes
Unit 3   Agricultural Engineers and the Public Extension System

All these units are demanding. They also deal with basic principles and values, which merit your attention and thought. Tackle them in separate study periods. You may require several hours for each.

We suggest that the Modules be studied one after the other, since they are linked by a common theme. You will gain more from them if you have first carry out work on the scope of Agriculture generally. You will then have a clearer picture about these topics.

Each study unit consists of one week's work and includes specific objectives, directions for study, reading materials and Self -Assessment Exercises (SAE). Together with Tutor-Marked Assignments, these exercises will assist you in achieving the stated learning objectives of the individual units and the course.

TEXTBOOKS AND REFERENCES

Certain books have been recommended in the course. You should read them before attempting the exercise.

ASSESSMENT

There are two aspects of the assessment of this course, the Tutor-Marked Assignments and a written examination. In doing these assignments you are expected to apply knowledge acquired during the course. The assignments must be submitted to your tutor for formal assessment in accordance with the deadlines stated in the presentation schedule and the Assignment file. The

work that you submit to your tutor for assessment will count for 30% of your total score.

TUTOR-MARKED ASSIGNMENT

There is a Tutor-Marked Assignment at the end of every unit. You are required to attempt all the assignments. You will be assessed on all of them but the best three will be used for the final assessment. The assignments carry 10% each.

When you have completed each assignment, send it together with a (Tutor-Marked Assignment) form, to your tutor. Make sure that each assignment reaches your tutor on or before the deadline. If for any reason you cannot complete your work on time, contact your tutor before the assignment is due to discuss the possibility of an extension.

Extensions will not be granted after the due date unless under exceptional circumstances.

FINAL EXAMINATION AND GRADING

The duration of the final examination for this course is three hours and will carry 70% of the total marks for the course. The examination will consist of questions, which reflect the kinds of self assessment exercises and the tutor marked problems you have previously encountered. All aspects of the course will be assessed. You should use the time between completing the last unit, and taking the examination to revise the entire course. You may find it useful to review your self assessment exercises and tutor-marked assignments before the examination.

COURSE OVERVIEW AND PRESENTATION SCHEDULE

You will liaise with your Tutor in the course of the facilitation and tutorials that shall accompany this course to enable you know the appropriate topics and time to submit the tutor-marked assignments on each unit within the semester.

HOW TO GET THE MOST FROM THIS COURSE

In distance learning, the study units replace the lecturer in a classroom setting. The advantage is that you can read and work through the study materials at your pace, and at a time and place that suits you best. Think of it as reading the lecture notes instead of listening to a lecturer. Just as a lecturer might give you in-class exercise, you study units provide exercises for you to do at appropriate times.

Each of the study units follows the same format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with other units and the course as a whole. Next is a set of learning objectives. These objectives let you know what you should do by the time you have completed the unit. You should use these objectives to guide your study. When you have finished the unit, you should go back and check whether you have achieved the objectives. If you make a habit of doing this, you will significantly improve your chances of passing the course.

Self Assessment Exercises are interspersed throughout the units. Working through these exercises will help you to achieve the objectives of the unit and prepare you for the assignments and the examination. You should do each Self Assessment Exercise in the study unit. There will be examples given in the study units. Work through these when you have come to them.

FACILITATION/TUTORS AND TUTORIALS

There are 13 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of the tutorials, together with the name and phone number of your tutor, as soon as you are allocated a tutorial group.

Your tutor will mark and comment on your assignments. Keep a close watch on your progress and on any difficulties you might encounter. Your tutor may help and provide assistance to you during the course. You must send your Tutor-Marked Assignments to your tutor well before the due date. They will be marked and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone or e-mail if you need help. Contact your tutor if:

- You do not understand any part of the study units or the assigned readings;
- You have difficulty with the self assessment exercises;
- You have a question or a problem with an assignment, with your tutor's comments on an assignment or with the grading of an assignment.

You should try your best to attend the tutorials. This is the only chance to have face to face contact with your tutor and ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from course tutorials, prepare a question list before attending them. You will gain a lot from participating actively.

SUMMARY

This course deals with 13 topics that are relevant to the course. These topics are broken down into units on diverse aspects of the course and they may influence its form and content.

We wish you success with the course and hope that you will find it both interesting and useful.

MAIN COURSE

CONTENTS   PAGE

MODULE 1

UNIT 1   UNDERSTANDING TECHNOLOGY AND THE CONCEPT OF SOCIAL CHANGE

CONTENTS

1.0   Introduction
2.0   Objectives
3.0   Main Content
            3.1   Meaning of Technology
            3.2   Indigenous Technology
            3.3   Agricultural Tools in Indigenous Technology
            3.4   Indigenous Beliefs on Cultivation, Pest Control, Harvest,
                  Storage etc.
            3.5   Technological Influence on the Social System
4.0   Conclusion
5.0   Summary
6.0   Tutor-Marked Assignment
7.0   References/Further Reading

1.0   INTRODUCTION

In recent times, the paradigm of development widely favoured by development theorists has shifted from the modernisation approach to farmer-centered strategies. An important component of these strategies include participatory technology development and transfer; encouraging interaction among the agricultural knowledge systems; farming systems and indigenous knowledge systems. When we speak about the impact of technology on society, we always talk about the positive effects of technology and on how technology has brought luxury to life, made life easy, about the Internet as an information resource and a communication platform and the others but most times forget or conveniently ignore the other side of its effects on the social system as a whole. Have you thought of the impact of technology from this point of view? Lessons from this unit will offer you the opportunity of taking a total look at the

relationship between technology and the equilibrium of the social system.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- differentiate the different schools of thoughts surrounding the concept of social change
- explain how social change affects your society and you as an individual
- discuss the manner and sources of social change
- mention the factors you will have to contend with as a change agent when introducing a change in your society.

3.0   MAIN CONTENT

3.1   Meaning of Technology

Technology is the application of knowledge of nature for achievement of goals. It includes the fashioning of instruments, synchronisation of activities with nature, use of natural materials and generation of ideas on practices. In every society, activities are undertaken making use of elements of the social system including human, material and non-material aspects, and this makes technology to exhibit certain uniqueness which is peculiar to the society. The activities vary from the simple domestic chores of home management to the complex farm activities, product processing, storage and conversion. Technology is developed over time and it often takes ages for a particular technology to be fully developed for use in a society and handed over to younger generations in the form of culture. Thus technology mirrors the fabrics of the society as represented by the social norms, values, beliefs and attitude of the people. No society is entirely devoid of technology and the dynamism of technology reflects the extent to which the society is open.

3.2   Indigenous Technology

When a technology is sufficiently pure to be composed of the art and artifacts of a society, developed over the years among the people and peculiar to the people, it is referred to as indigenous. It is often an outstanding attribute of the society which is closely linked with specific areas of success in their lives. While indigenous technology can be considered location-specific, its spread will indicate the relatedness

among people across a given geographic area. So an indigenous technology may be found among people of common ancestry e.g. the use of mortar to grind pepper among the Igbo. However, the use of indigenous technology limits the scope of agricultural activity and likewise the yield which oftentimes is not enough for the farm family.

3.3   Agricultural Tools in Indigenous Technology

The practice of agriculture involves the use of tools and instruments to complement human energy in carrying out activities like tilling and preparing the land for planting. The tools are necessary to prevent damage to the hand and to facilitate the job. The common tools are hoes and cutlasses and vary depending on the intensity of the particular job and the culture of the area. For example, it is known that heaps for yams are different from that of maize and often require different type of hoes; also hoes used in Yoruba land are different from those in use in Nupeland.

3.4   Indigenous Beliefs on Cultivation, Pest Control, Harvest, Storage

Apart from land preparation, there are other agricultural activities related to maintenance of crops and livestock. Over the years, indigenous tribes have developed techniques for managing pests and diseases both on the field and storage, making use of local materials. For example, use of water from locust bean processing, neem leaf and palm kernel oil. Also, there are various beliefs on cultivation period and in some communities these activities are ushered in with festivals and rituals. While these beliefs cannot be tested scientifically, the believers hold strongly to them and will not do anything to challenge them. Similar beliefs are displayed during harvest especially for special crops like yam.

It is often believed that there are certain unseen influences that affect activities and outcomes and that these will remain as expected as long as the usual procedures are not changed. So when the unexpected happens, investigations are made as to what was done that should not have been done.

3.5   Technological Influence on the Social System

Technology can be said to have been derived from the social system being a product of the elements of the culture. Technology can be taken as the apparent tool available to members of the community in their engagements including economic activities. Being integrally related to the social structure of a society technology has a lot of influence on people statuses and roles. This happens because technology facilitates activities especially productive ones and therefore improves income generation potential of users of technologies. The system of production of a society is the basis of all other institutions in the society. This means that those who use technologies in the society are supposed to be superior economically, have higher social statuses and perform superior roles in the society because they engage tools which are capable of enhancing production and productivity.

The social system, however, is a dynamic entity partly because of changes naturally occurring or due to interaction with other systems, the result of which includes exchange of ideas and practices that eventually bear on the existing technology. New ideas are learnt as a result of human movement into and out of the community through which technology is translocated; giving rise to new ways of doing things in the community. As changes come into the system, the culture is also affected and all other things that relate to it. The resultant change in components of technology introduces new ways and ideas about production and economic activities. For those who are affected by the technological changes, their social economic status and societal roles change drastically. Occupations may be affected, new roles created while existing ones give way and sources of income-generation change in nature and effectiveness. In some cases, new entrepreneurs emerge with a new socio-economic class and the power structure in the system may be affected.

4.0   CONCLUSION

In this unit, you learnt about the meaning of technology and how it mirrors the fabrics of the society; indigenous technology and how it impacts on agricultural development and how technologies in general influence the social system.

5.0   SUMMARY

In this unit, you have learnt that:

- technology mirrors the fabrics of the society as represented by the social norms, values, beliefs and attitude of the people

- no society is entirely devoid of technology and the dynamism of technology reflects the extent to which the society is open
- when a technology is sufficiently pure to be composed of the art and artifacts of a society, developed over the years among the people and peculiar to the people, it is referred to as indigenous
- the use of indigenous technology limits the scope of agricultural activity and the yield which oftentimes is not enough for the farm family
- technology facilitates activities especially productive ones and therefore improves income generation potential of users of technologies
- those who use technologies in the society are supposed to be superior economically, have higher social statuses and perform superior roles in the society because they engage tools which are capable of enhancing production and productivity.

6.0   TUTOR-MARKED ASSIGNMENT

i   Explain the following terms (a) Technology (b) Indigenous technology.
ii   Mention 5 indigenous beliefs on cultivation, pest control, harvest and   storage of crops.
iii briefly explain how technology can facilitate class creation in a society.

7.0   REFERENCES/FURTHER READING

Bandara, J.M.R.S. (2007). "Nature *Farming: Integration of Traditional Knowledge Systems with Modern Farming in Rice"* at http://www.compasnet.org/publications_2.html

Dayanatha, J.H.A. (N.D.). **"*Indigenous Technology and Agricultural Research System"*. National Centre for Agricultural Economics and Policy Research, New Delhi – pp.110 012

http://ageconsearch.umn.edu/bitstream/47353/2/1-D-Jha.pdf

Í

UNIT 2 UNDERSTANDING TECHNOLOGICAL CHANGE

CONTENTS

1.0   INTRODUCTION

The application of technology is visible in all spheres of life and it transcends all human endeavours. It can be rightly said that life is about technology, even the early man was bothered about how to do things better as he fashioned tools for hunting and farming. As human endeavour became more challenging, technology was always called in to ease stress of doing things. However, as technology changes, the society at large also changes. The extent of change depends on the magnitude of change that occurs to technology.

2.0   OBJECTIVES
At the end of this unit, you should be able to:

- understand technology as a pro-social change tool
- develop interest in exploring the opportunity of technology to
  change something around you

- explain how technological change in one part of the society affects another
- discuss the mental ability to manage resistance to technological change

3.0   MAIN CONTENT

3.1   Technological Changes in Transportation

Physical movement is an important attribute of man, being non-sedentary. Large populations have been reported to move from one location to another covering large distance. This is supported by discoveries of people in an area being traced and linked with another settlement far away. This can only be possible through movement. However, human movement was basically through trekking and use of beasts of burden (horse, donkeys, camel etc) and this used to be on land and covering many days to accomplish a journey.

Technology changes in transport have manifested in areas of the medium and the equipment/tool. This has led to the exploitation of water and air as media for transportation while the land has been reinforced to form roads. The tools for transportation still continue to be changed or developed to improve the efficiency and maximise the use of time and other resources. Thus, the use of animals or travelling on foot has become obsolete and most uncomfortable for man.

These changes due to new means of transportation can be viewed in the following ways:

At the end of this unit, you should be able to:

- understand technology as a pro-social change tool
- develop interest in exploring the opportunity of technology to change something around you
- explain how technological change in one part of the society affects another
  discuss the mental ability to manage resistance to technological change.

Í

The changes are not limited to the above and they can even vary from place to place. The important thing to note is that changes to any aspect of the system will have far reaching implications on other aspects.

3.2   Technological Changes in Communication

Communication is also a vital part of human life; in fact it is the basis of any relationship. It begins with simple dyadic relationships and becomes more and more complex as it gets applied to leadership in the community. Exchange of information helps to arrive at a common understanding of what the issue is and thus the reaction of an individual. Communication is used to inform, inquire, agree or disagree to an issue of common interest. In those days, each community had its own peculiar way of passing information across to the people and languages, even dialects, were also developed along similar lines. This attribute became associated with communities, events, periods and individuals and other members learned to listen, decode and understand what is communicated. It should be noted that communication transcended use of words but included gestures, looks, dances, displays and other sounds and instruments. For instance, a man putting his two hands on his head indicates sorrow in Yoruba land or having palm frond tied to a vehicle indicating presence of a corpse.

Development in communication reinforced by education brought another dimension and with evolving technology, things like letter writing overcame the issue of distance in communication but not that of time. In the recent times, communication has recorded the greatest global advancement which has made nonsense of distance and time. Starting with the radio, television, the computer, the internet to mobile phones, 3G communication and the end is still far away.

Changes to communication technology have reduced vast physical distances between people as well as time needed to traverse the distances. This has made communication to be less personal as against what traditional means emphasised.

Communication has, above all, been responsible for profound changes in the culture and consequently influenced several activities and ways of doing things, including agricultural tools and equipment. In actual fact, communication actively introduces new technologies as well as training on the uses. It is also responsible for the interaction across communities that eventually result in changes. With the recent speed in communication and the corresponding response or feedback, the world can rightly be described as a global village.

Communication (postal, news, wireless etc), health (superstitions, beliefs, hospitals), education – formal scientific education, economy/traditional farming transformed through i
crops, improved varieties (plant or animal, chemicals, machinery), even in leisure (recreational facilities, cinema), housing etc.

3.3   Resistance to Technological Change

Resistance is a form of stability affecting people and especially when faced with opportunities for change. Sometimes, managers and consultants put themselves into the position of change agents - in other words, they are demanding change from their staff and organisations. If they fail to receive full and prompt cooperation with
organisations. If they fail to receiv
these demands, these change agents experience annoyance and frustration. However, once a change is implemented, the same managers and consultants will themselves try to resist any attempts to divert or pervert the change, or to revert to the previous state. Within the change management literature, there is some material on anti
although the topic is often ignored or skimmed over.

It is important to note that resistance should not be seen as something be overcome, but as something to be understood and accommodated. Many people in technology change management talk about overcoming resistance. Technology change is seen as a battle between the forces of progress (i.e. the champions of technology) and th
This echoes a popular theme in psychotherapy, where the therapist is supposed to overcome the resistance of the patient interpreted as a sign of hostility on the part of the patient.

3.3.1 Levels of Resistance

Rick Maurer has identified three levels of resistance, calling for three entirely   different   anti   tactics.

■	Level 1 - Informational	People lack information or understanding about the change.	Tactic: provide more information and explanation. Lots of training.
■	Level 2 - Gut	People regarding change as a	provide

	Reaction	threat, and responding emotionally or physiologically ("gut" reaction).	reassurance, motivation, "safety nets", and so on.
	Level 3 - Cultural the	People seeing change in the context of a prior history of conflict.	Tactic: political negotiation.

He believes that many change initiatives fail, not because of resistance, but because of an inappropriate response by management to this resistance. This most commonly appears in the form of a Level 1 resistance to a Level 2 resistance.

Respecting and Preserving Resistance
3.3.2 Respecting

In popular psychotherapy, the therapist is supposed to overcome the resistance of the patient - resistance is interpreted as a sign of hostility
resistance of the patient
on the part of the patient. However, the radical French psychoanalyst
, disagreed with this -- in his view, resistance is not a
Jacques Lacan, disagreed with this
question of hostility, but a structural phenomenon. Resistance is to be valued and respected.

A similar disagreement can be found among consultants and managers involved in change within the organisation. Although many hold th popular view (resistance is hostile, needs to be overcome), there is a more subtle view, in which resistance is respected.

Given that change agents usually want to make lasting changes, and to leave the organisation in a stable condition, they need to take care when overcoming resistance. The organisation should remain able to resist many other changes, as well as resisting an immediate reversal of the desired changes. Furthermore, resistance is closely related to resilienc which is vital for organisations dealing with operational failure and occasional crisis.

3.3.3 Understanding and Interpreting Resistance

Stratification of Resistance

1.   Surfacing resistance: Under what circumstances does the resistance surface? There are some organizations where rational resistance (due critique) is impossible (taboo), and people find

ways of accommodating change rather than confronting the issues. From a psychoanalytic perspective, resistance inevitably surfaces somehow, but often in a distorted form: dysfunctional behaviour, or what might be called symptoms of the repressed resistance. It then takes an analytic process similar to psychoanalysis to put the organisation on the couch for diagnosis with a view to understanding these symptoms.

2. Inexplicable resistance: In this case, there seems to be no apparent reason for the resistance, everyone appears to want the innovation, but the innovation does not happen. There is some inertia - resistance to change - which cannot be located in any particular person or group or procedure, but pervades the organisation. This inertia is sometimes equated with bureaucracy, but it is just as often to be found in the most anti-bureaucratic organisations. To work effectively with these societies, the change agent has to go beyond the rationalist notion of resistance with its anti-resistance tactics, and find a way of working with or above the resistance. We seem to need to think in terms of the 'architecture' of the society, in the sense of a topological structure that makes some things accessible/possible and other things inaccessible/impossible.

3.3.4 Resistance and Rationality

From whose perspective?

It is important to consider the rationality and subjectivity of resistance. From what (or whose) perspective (if any) does the resistance make sense, in terms of a set of perceptions, beliefs, values and priorities? If this question can be answered, there are several anti-resistance tactics for the innovation champion, including:

(a) Persuasion (changing the perceptions and beliefs of the resisting folks);
(b) Negotiation (changing their priorities by offering them some incentive or removing some disincentive); and
(c) Marginalisation (changing the innovation and/or the organisation so that the resistance becomes acceptable or irrelevant - in extreme cases, this may mean taking the resisting folks out of the frame altogether).

Is it sometimes rational to resist?

11

Í

'Resistance can be a sound and smart response to a flawed initiative'
This statement assumes a notion of rational behaviour.   There is an
important connection between resistance and rationality. One starting
point for discussing resistance is that of a change agent, who has a set of
change goals, and regards anything or anybody who gets in his/her way
as a nuisance. Resistance is stupid and has to be overcome, using force,
guile, patience or whatever other strengths and resources the change
agent can access. This is all defined in terms of the change agent's goals.

If an initiative is flawed, this is presumably also relative to the change
agent's goals. The resisters share the change agent's goals, but disagree
with his/her tactics. It may be sound and smart for them to resist (due
critique), and it may be sound and smart for the change agent to
allow/encourage this resistance.

But of course, what counts as sound and smart behaviour for the
resisters depends on their assessment of the reasonableness of the
change agent, especially if the change agent appears to have more power
and status than they have. There are enormous cultural issues here.

Cooperation and trust

There are also issues of trust. The change agent may say that
constructive criticism is welcome, but do we dare to say what we really
think? We may think we are making constructive criticism, but other
people may think we are engaged in nit-picking or even deliberate
delaying tactics. What if the change agent has the power to influence my
career if I step out of line? Are self-organising systems most receptive to
change? Some recent work in cybernetics would suggest the reverse. A
self-organising or self-producing system, which Maturana/Varela calls
an autopoietic system, is one that is concerned with the need to preserve
its own identity and coherence.

Preservation of identity equals resistance to changes that threaten
identity. A biological entity has a skin that separates inside from outside,
and an immune subsystem that rejects foreign implants. These defenses
and boundaries are part of the process of self-organisation. An
autopoietic system is, in a sense, a closed system. (Compare: the Ego as
a defense system, a self-identity which often prevents the individual
acting in his/her own best interest.)

And even the change agent wants the organisation to have sufficient
resistance (or at least hysteresis) so that valuable changes, once made,
are not immediately dissipated by other changes. There is a chart

Í

produced by a large American engineering firm, boasting of all the quality initiatives it has implemented over the past couple of decades, but there are so many of these initiatives that it creates an impression not of comprehensive endeavour, but of inconsistency and fashion-chasing.

4.0   CONCLUSION

This unit has enabled you to understand technology as an important tool to promote change and development of the people and the society. This awareness is expected to spur you towards initiating another dimension of change in your society using the opportunities of technology   around you.

5.0   SUMMARY

This unit has acquainted you with:

- what technological change connotes
- trends of technological change in transport and communication sub-sectors in our   society
- the forms of resistance to technological change
- knowledge to curtail resistance to technological change.

6.0   TUTOR-MARKED ASSIGNMENT

i.   Mention 10 areas of life where technological changes have been experienced in Nigeria in the last 20 years.
ii.   In what ways can the changes due to new means of transportation be viewed?
iii.   Mention 2 merits and demerits of road transportation.
iv.   Itemise 3 possible reasons why people may resist technological change and the tactics you will employ as a change agent to manage them.

7.0   REFERENCES/FURTHER READING

Í

Jaffe, A. B. *et al*. (2000). "Technological *Change and the Environment*" In: M. Karl-Goran and V. Jeffrey (Eds). *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science. pp. 10-11.

Paul, C. (2007). "A Framework for Understanding Technology and Technological Change." *The Public Sector Innovation Journal*, Volume 11(1), Article 3.

UNIT 3   BASIC SOCIAL CONCEPTS

CONTENTS

1.0   Introduction
2.0   Objectives
3.0   Main Content
       3.1   Theories of Social Change
              3.1.1   Sources of Change
              3.1.2   Time-Span of Change
              3.1.3   Effect of Change
       3.2   Social Change
       3.3   Sources of Social Change
              3.3.1   Other Sources of Social Change in Nigeria
       3.4   Nature of Social Change
       3.5   Factors Influencing Acceptance or Resistance to Change
              3.5.1   Characteristics of Innovation
              3.5.2   Characteristics of the Society

1.0   INTRODUCTION

We need good theories of social change for building the thinking of all involved in processes of development, as individuals, as communities, organisations, social movements and donors. The conventional division in the world today between policy-makers (and their theorising) and practitioners is deeply dysfunctional, leaving the former ungrounded and the latter unthinking. Good concepts help us to grasp what is really happening beneath the surface. In the confusing detail of enormously complex social processes, we need to turn down the volume of the overwhelming and diverse foreground and background "noise" of social life, to enable us to distinguish the different instruments, to hear the melodies and rhythms, the deeper pulse, to discover that "simplicity on the other side of complexity." We need help to see what really matters. As social development practitioners we need theory to help us to ask good questions, more systematically and rigorously, to guide us to understanding, to discovering the real work we need to be doing, primarily assisting communities and their organisations to understand and shape their own realities.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- differentiate the different schools of thoughts surrounding the concept of social change
- explain how social change affects your society and you as an individual
- discuss the manner and sources of social change
- mention the factors you will have to contend with as a change agent when introducing a change in your society.

3.0   MAIN CONTENT

3.1 Theories of Social Change

The theories about social change have been generally concerned with a number of things which aim at explaining certain concepts.
i)   Explanation of sources of social change.
ii)   Time span of change i.e. time taken between first occurrence and when it eventually affected people.
iii)   Effect of change on changing unit
        Several schools of thought have been concerned with these issues.

3.1.1   Sources of Change

Sources of change in a society can be taken to be a system which is comparable to any living system.   And that any living system is in a state of dynamic equilibrium and from   time to time certain parts of   the system fail to function well implying that all the parts do not always keep up with the expected equilibrium.   The parts are the social institutions which keep the system in a balanced state but when they fail to function because of shortage of energy or some form of shock, this slows down the system and brings it into a sort of homeostasis until the former equilibrium is re-attained.

The source of change can be external and internal.   External is from weather, climate or other links with the external environment including other social systems.   Internal sources include things that can be traced to what occurs within the system itself, like leadership changes, invention, discovery or reorganisation.

3.1.2   Time-Span of Change

How long it takes for change to be effected is an important way of knowing how simple or complex the change is. Often times change is seen as a timeless thing which is linked with evolutionary trend and thus inevitable. Otherwise change can be traced to timed events which may be linked with the beginning or when it became effective. The effectiveness in this case implies when the objective of the change initiative becomes predominant among the population. Change can be of linear form in which there is a peak and an eventual decline, or it can be in circular form with one change leading to another which also influences the initial one while again leading to another, e.g. agricultural productivity which enhances other development until war weapons and downfall follows.   The peak of the cyclical form is the top of the circle.

3.1.3. Effect of Change

Change is ubiquitous in the society and right from the primitive state when needs of people were minimal, there has always been that drive to do better, an urge inherent in man. But as weapons were made, some killed more animals and conflict started as a result of differential efficiency which began the creation of class. The creation of classes impacted on social organisations eventually leading to division of labour and specialisation.

The equilibrium camp believes that the government should promote the needs attainment of the people. They do not believe in the existence of class among people. They also believe that people share interests and there is no conflict.

Conflict Camp: This camp is championed by Karl Marx although others initiated that before him. They do not totally disagree with the structure and function of society according to the equilibrium camp. They are not interested in equilibrium which holds that it takes the system of production to be the basis of all other institutions. They are not interested in social institutions except as they cause change /conflict. For them, the society tends to pass through stages in an evolutionary manner. I.e. evolves from state of primitivity when needs of people are minimal and there is no problem. The conflict expanded as the less efficient started labouring for the more efficient, hence classes of owners and non-owners emerged. The term "class" is a real thing therefore. It is the sense of exploitation which the non-owning class feels that brings them against the owners and clashes to reverse the situation is called Dictatorship of the Proletariat. Marx maintains that economy is the source of change, class and conflict in the society.

After Marx, the Neo-Marxists, those who follow his ideas basically and later go ahead to modify it arose. They say it has not been possible for workers to team up and take over from the administrators. Even if they wanted, the owners are anonymous and they do not know who to take-over from. The managers are mere employees of owners who only have stocks in the company (Joint-Stock Company). It is therefore difficult to observe a class of owners in exclusion of non-owners. Thus any change in the class situation will have to involve the coming together of members of each class. The so-called down-trodden workers cannot successfully lead themselves to overpower the owners, except if a dissatisfied owner teams up with them. They need knowledge of

17

entrepreneurship to fight the owners and continue the operation of the system or else everything breaks down. Marx termed entrepreneurship as a surplus power and the gains from it should be shared by everybody.
The source of change is not only the economy and may be from administration and knowledge. The Neo-Marxian analyses Marx view of exploitation to societal situations. E.g. land tenure system: there exist two unequal groups or classes. The Marxist idea looks at change as for whom, what, why. While the equilibrium camp assumes that it favours everybody.

3.2   Social Change

Social change can manifest in many forms:

i).   Economic change in mode of production, distribution to consumption e.g. use of better techniques lead to large scale production and large investment while traditional products may be displaced.   Changes in statuses then follow and economic gap increases.   New statuses are even created e.g. distributors, retailers, and wholesalers.

ii).   Political change: deals with change in distribution of operating mechanism of political power in the social system e.g. the monolithic power structure (single man rule) in the traditional situation may be changed to pluralistic power structure i.e political power being distributed to different bodies.

iii).   Technological change: Technology entails ways of applying scientific or other organised knowledge to practical tasks. Technology change therefore is a continuous process of change with technology material, physical practices of culture. Technology change manifest in transport (road and water), communication (poster, news, wireless etc), health (traditional medicine, herbs, hospitals), education – formal scientific education, economy/traditional farming transformed through introduction of cash crops, improved varieties of plant/animal, chemicals, machinery), even in leisure (recreational facilities, cinema, resorts), housing etc.

iv).   Cultural change: changes in non-material aspect of culture e.g. change in traditional ways of worship i.e. polytheism to monotheism, change in dressing, livelihood patterns, inheritance etc.

v).   Behavioural change: arising from influence of education on attitude of people e.g. wife equal to husband, death sanctions, migration of youths to urban areas.

3.3   Sources of Social Change

Change is usually brought about through invention, diffusion or discovery.

- Invention: recombination of existing cultural traits to fashion new things of the rate of its occurrence is directly related to the existing cultural traits.
- Discovery: sharing of perception of a fact, object or relationship, what has already existed but unknown to others which can enhance the cultural base of society thereby enhancing invention.
- Diffusion: cultural diffusion takes place at material and non-material level of the process has been enhanced by increased to more efficient communication facility, speed of traveling around, existence of specially trained personnel in diffusion.   The process is simply the spreading of ideas.

3.3.1   Other Sources of Social Change in Nigeria

(a)   Religious Institutions which brought changes in the world view of individuals, thus, formal teaching, doctrinal teachings and the use of metaphors to remould attitude of individuals.

(b)   Urbanisation: - growth of cities attract youths from rural areas:- increase in population, trade, industries and all others have necessitated tremendous adjustments for the individual.

(c)   Government Policy: - Decrees, Laws, Ethics, are introduced to control peoples way of life.

(d)   Application of Science and Technology: - Patterns of rural life has changed as a result of introduction of electricity and water. People's lives have also changed due to consumption of imported food and fascination for other materials; cultivation of new breeds of plants and animals, mechanisation   causes extreme commercialisation of agriculture and farm size. The implication is that only few people will remain in the family because of economic or land constraints. Mutual aid system in rural areas will also lead to change e.g. communal functions: planting; harvesting etc will give way to contractor functions. There will be increased demand for infrastructure and overhead facilities to cope with the commercialisation. Leadership patterns in the community will change and be based on advisements rather than ascriptions. A market socio- economic disparity and stratification

of community will occur, with the rich becoming richer and poor poorer.

(e)   Natural Physical Forces: Wind, flood, drought, erosion, insect and pest infestation, erosion and other mishaps usually lead to destruction of livelihoods and shelters. The adverse effect make life difficult for survivors as the basic necessities of food and shelter are lacking as a consequence and may cause relocation of villages. The corresponding disasters call for applicable mechanisms to bring about solutions.

3.4   Nature of Social Change

- May be planned or unplanned. Planned usually entails direct human intervention in shaping of direction of change towards uniform goal. Accidental or unplanned change is that which appear suddenly and usually through act of nature, giving man no chance to plan for its occurrence. Examples include flood, locust infestation etc. In planned change, goals are clearly defined which means uncertainty is minimised. Unplanned change is usually very costly.
- Change may be total or segmental depending on coverage. Total change mainly covers a wide range of activity which leads to complete transformation of people's way of life or the social institution. Segmental change covers particular parts which may not call for total transformation of the system e.g. Western medical practices existing with traditional are segmental. It may also be total in terms of people that it affects in the society.
- By the way of introduction of the change, it can be immanent or contact as identified by Everett Rogers. Immanent changes are inherent in the system itself thus arising from natural movement and internally generated change i.e. no external influence. Contact changes are introduced from external sources and this may be of 2 types (a) selective contact change in which an outsider intentionally communicates or introduces an innovation into a social system. The change is selective in that it is only those who are interested that adopt the change (b) direct contact change: outsider on his own or as representative of agency deliberately introduces change into the system with the aim of changing the people's specific activities.

3.5   Factors Influencing Acceptance or Resistance to Change

These are factors causing change in the society, characteristics of target or a combination of these.

Í

3.5.1 Characteristics of Innovation

- Relative Advantage: The extent to which an innovation is superior to what it is meant to replace. This may be explained in economic and social terms. Those that show immediate relative advantage are easily accepted.   Often a crisis may underlie the relative advantage of an innovation e.g. economic lowliness aids campaign in favour of local goods.   Farmers adopt more innovation after a natural or social crisis than in normal periods.
- Cost: Relative advantage may be high but cost too high, hence they will adopt more slowly.   Cost may also be talked of in terms of what the adopter of the innovation is losing e.g. introduction of oil palm mills in 1950s in Southern Nigeria, it had high relative advantage but the kernels could not be available together with nuts and shafts to the housewife.   The women therefore did not like the machine and this led them to its rejection. An innovation may also call for further investments e.g. tractor adoption calls for expansion of operations on farm, payment for driver, parts, oil, service and housing.   All these add to the tractor hiring cost and may also be calculated in terms of time.
- Complexity: The extent to which an innovation is relatively difficult to understand. Simple innovation tend to be more readily adopted than complex ones e.g. keeping farm records is more complex than adopting new variety of seeds.
- Visibility: Innovation varies in extent to which results are easily seen. Demonstrations that show what will happen after adopting an innovation prompt more adoption.
- Divisibility: Extent to which an innovation can be tried in parts or limited scale.
- Compatibility: Extent of consistency to existing cultural values, norms and past experiences of adopter.
- Western Nigerian farmers adopted yellow maize variety and refused to plant it the following year because it produced yellow pap which the people were not used to. In the North, sharper stalked guinea corn was introduced out of double yield but it was rejected because the stalk is not useful for building fences and feeding animals like the traditional variety. When an innovation conflicts with existing behaviour or existing values, it can be rejected out rightly or readjusted or people may simply rationalise the acceptance of the change.

- Additive or substitutive: An innovation which is merely addition innovations are more readily adopted than substitutive.

3.5.2   Characteristics of the Society

The rate at which society changes and the magnitude of change depends on the following factors:

- Physical Environmental Factors: Climatic changes, quakes etc. which may cause population decrease or migration of people or change in trade through introduction of technology and its components.
- Migration and Population Changes: Most people come in contact with and see new cultural changes in their new environment. Cultural changes are lower in emigration centres and higher in immigration centres i.e. rural and urban respectively.
- Culture and Structure of Society: Culture can act as impediment towards change when certain values are highly cherished because people tend to resist change in their direction. Old conservative leaders will also change less rapidly than the young, reactionary leaders. The former are reluctant to try new things and prefer to rely on past experience.
- Occurrence of Great Men: Strong willed and charismatic people as leaders enhance dramatic changes which are rapid e.g. the military leaders encourage more changes- Nigeria, Libya, Togo and China compared with Malawi.
- Prevailing Attitude and Values: Societies with critical attitudes are more inventive and therefore open to change.
- Perceived Need: Innovation that is meant to address the perceived needs of the people is more easily adopted.
- Relative Isolation of particular society and relative contact:- Societies with close contact change more rapidly than those isolated e.g. farmers with less contact with extension agent changes and adopt lesser innovations.
- Cultural Base: Accumulated knowledge, techniques and traits in a culture and the greater this accumulation the more invention can take place.   As cultural base increase by multiplication the amount of invention that can come up in that society increases exponentially. This is called the exponential principle and has been traced in USA, Russia and Japan. A country that is willing to borrow ideas and traits from others is more open to change.

4.0   CONCLUSION

This unit has enabled you to understand the important theories related to social change, the manner and the sources through which change can be experienced and the factors/characteristics which you as a change agent must be aware of for a successful delivery of change agenda to a society or any group of people you may work with.

5.0   SUMMARY

In this unit, you have learnt that:

- change can be of external (from weather, climate or other links with external environment) or internal source (leadership changes, invention, discovery or reorganisation).
- often times change is seen as a timeless thing which is linked with evolutionary trend and thus inevitable and that change can be of linear form in which there is a peak and an eventual decline, or it can be in circular form with one change leading to another which also influences the initial one while again leading to another.
- social change can manifest in many forms including economic, political, technological, behavioural and cultural change.
- change is usually brought about through invention, diffusion or discovery.
- social change may be planned or unplanned, segmental or total, immanent or contact.
- certain characteristics of the innovation and the society affect acceptance or resistance to change.

6.0   TUTOR-MARKED ASSIGNMENT

i.   Explain how social change can be experienced in technology, politics and behaviour of individuals.

ii.   Briefly explain the following terms viz-a-viz nature of social change:
      (a)   Unplanned change
      (b)   Segmental change
      (c)   Contact change

Í

iii.   Mention 2 factors that may influence acceptance or resistance to change and list 3 characteristics of each.

7.0 REFERENCE/FURTHER READING

Doug, R. (2008). *A Theory of Social Change and Implications for Practice, Planning and Evaluation*. (www.cdra.org.za/A)

MODULE 3

UNIT 1 INFLUENCE OF TECHNOLOGICAL CHANGES IN NIGERIAN AGRICULTURAL DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

The notion that agriculture, as a global practice, has been exploiting resources faster than they could be renewed has been a topic of discussion

and debate for decades, perhaps centuries. Symptoms of imbalance have been seen in the form of pollution, soil erosion/loss, wildlife population decline/shifts, and general alteration of a "natural" flora/fauna as a result of human intervention. Indeed, agricultural practices are undeniably "unnatural", regardless of whether the production is a one square meter vegetable garden in Nigeria or a one million hectare rubber tree plantation in Malaysia. Of course, an equally unnatural and parallel phenomenon has been the exponential growth in human population, with associated demands for both food and shelter, which have often exceeded the "natural" carrying capacity of land. Based upon the premise that human population growth will not be constrained as a result of food shortages due to overriding social values, this unit makes five assertions regarding the desirable influence of technology changes in Nigerian agriculture. Also, undesirable influences of technological changes were summarised in two paragraphs.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- explain the significance of improved technology to Nigerian agricultural development
- state the implications of technology change on the local indigenous practices of Nigeria farmers
- identify the value of indigenous knowledge for food production
- discuss the need for both modern and indigenous knowledge for holistic agricultural development.

3.0   MAIN CONTENT

3.1   Desirable Influence

3.1.1 Technology has/will Increase Agricultural Productivity

Food is subject to the economic principles of scarcity. Unlike the artificial value of scarce items such as gold, an adequate supply of food is paramount to population survival and skill diversification, making agriculture a first level priority. Technology has enabled human civilisation to leave the "Hunter / Gatherer" paradigm of existence and concentrate labour and land to the sole purpose of food production on an ever-increasing scale. The concept of "scientific agriculture" dates to publications by Liebig in 1840 and Johnston in 1842, which speculated about the role of chemistry in agriculture. The concepts of inheritance and Mendelian genetics were soon

to follow in 1865 and subsequently stimulated the biological basis for modern agriculture. Soon, science-based institutions in Europe and North America eagerly expanded the application of biological and chemical sciences to agriculture, spawning new technologies and approaches. These early applications of technology have not only increased food production in real terms, but have dramatically reduced the number of individuals directly involved in food production/processing – enabling the diversification of society to address social issues not directly related to "survival", but generally seen to increase the quality of life.

To deny the role that biological and chemical technology have played, continue to play, and will play in the future development of agriculture is to deny natural history itself. The indiscriminate or inappropriate use of chemical and biological technology, however, can clearly produce negative consequences to the ecosystem and threaten the long-term viability of the enterprise. The central issue of sustainability, therefore, is preservation of non-renewable resources.

Food production, habitat preservation, resource conservation, and farm business management are not mutually exclusive objectives. Credible arguments have been advanced to suggest that production of food via high-yield agriculture techniques can meet the nutrition requirements of the global population. The balance can be achieved through planning land use – with a considerate analysis of what parcels of land to employ for high-yield agriculture while retaining marginal or poor land for non-agricultural activities or wildlife habitat preserves. Studies to quantify the impact on production of reducing or limiting inputs to agriculture have suggested that yields/hectare would decrease from 35% to 80% depending upon the crop. Without a concurrent decrease in demand, the amount of land that must be utilised would increase dramatically. In fact, global land in production today, which is roughly the size of South America, would need to be the size of South America and North America if the high yield benefits of technology were not employed (Richards, 1990). If the motivation of sustainability is optimisation of production and resource conservation objectives, then progress can clearly be achieved.

3.1.2   Technology as the Basis for Sustainable Agriculture

Sustainability in agriculture relates to the capacity of an agroecosystem to predictably maintain production through time. A key concept of sustainability, therefore, is stability under a given set of environmental and economic circumstances that can only be managed on a site-specific basis.

Í

If the perspective of sustainability is one of bias against the use of biological and chemical technology, and espouses a totally natural ecosystem, then agriculture as a practice is already excluded. If, on the other hand, the perspective of sustainability is one of preservation of non-renewable resources within the scope of the agricultural enterprise, then the objective is not only achievable, but good business practice and good environmental management.

To a large extent, the rate of technology development and the degree of innovation in future technologies will greatly influence the stability, and certainly the productivity, of agriculture. Technology, in the classical sense, includes the development and use of nutrients, pest control products, crop cultivars, and farm equipment; but it also includes the vision of genetically modified crops providing greater nutritional efficiency (more calories per yield, or more yield), manipulation of natural pest control agents, and use of farm management techniques that focus on whole-farm productivity over time, not just annual production per hectare. Consider the basic premise of biotechnology: the least expensive and most renewable source of energy on Earth is the sun and the most abundant and predictable mechanism to convert the energy from the sun to useable energy is photosynthesis -- biotechnology has enabled methods to direct abundant natural energy to new more efficient or unique food products. The imagination is literally the limit to the opportunities. Short term objectives will of course focus on yield, quality, and input reduction. Long term, however, the genetically-created "transmissions" will focus on creating super-nutritious feed for animals, plants that out produce the subtractive influence of pests (making "tolerance" a key pest management tactic), physiological adaptation to out-compete adjacent species (e.g., weeds), drought stress tolerance, and overall improvement in the rate of photosynthesis (leading to any number of industrial applications).

The development and use of agricultural technology is not, however, limited to genetic wizardry. Indeed, the use of computational technology, combined with geographical location devices and remote sensing advancements, promise to radically change the way all crops will be managed. Commonly referred to as "Precision Agriculture", the underlying theme is integration of information to create management knowledge as a means to address site-specific production goals. Uncertainty with the environment will always be a key issue with agriculture, but this too will be managed as environmental modeling, combined with risk management algorithms, will lead to the optimal use of genetics on specific soils within known weather profiles. And, breakthroughs will continue to be seen in the "classical" technologies that have exponentially increased world food

production since the advent of "scientific agriculture" in the late 1800's. In addition to advances in productivity, technology will be used to remediate land that has been overused or misused through poor agricultural practices. The concept of Best Management Practices will continue to be a key focus, regardless of the current state of technological offerings. Strategies, such as Integrated Pest Management (IPM) consider the site-specific circumstances, but also the values and business considerations of the agricultural producers. IPM has been essential in describing the role and rationale for responsibly managing pests, pointing scientists and practitioners alike to identify future needs in biological information, and placing pest control in perspective with production goals. To this end, the concept of pest Economic-injury Levels has been central to dismiss the notion that pests must be controlled at all cost in favor of break-even analysis.

Sustainability is indeed an issue of survival, but is far broader than the concept of habitat destruction and soil erosion. Sustainability includes the goal of food production, welfare of the food producers, and preservation of nonrenewable resources. To that end, technology of all types has been and will be the enabling man-made component that will link these two overriding objectives. Indeed, history confirms that technology has been essential to agricultural productivity/stability; current breakthroughs in technology confirm that the discovery and development of new technologies is a sustainable endeavor, and common sense directs us to the conclusion that technology will enable Sustainable Agriculture.

3.1.3 Improved Planning of Agricultural Development Programmes

The introduction of science and technology into agriculture through the efforts of extension has helped in the planning and implementation of agricultural development programmes in a scientific way. In other words, it has helped the Nigeria farmers to think and act more on scientific lines rather than the traditional way of thinking and acting.

3.1.4 The Concept and Practice of Development Communication

This has been successfully introduced to the fields of agriculture through the deployment of appropriate information and communication tools such as the telecentre, mobile telephones, and others.

3.1.5 Stabilised Food Production and Regular Market Supplies

The introduction and adoption of irrigation technologies especially in the northern parts of the country has reduced the heavy dependence on rain fed agriculture which had hitherto caused high fluctuations in annual production and increased food insecurity.

3.2   Undesirable Influence

3.2.1   Digital Divide

Many people see technology as a solution to some of the problems that exist on our planet. It is true that technology can be used for good, but with new developments come new challenges. The digital divide is one of such, one that people are actively trying to overcome. For example, telecentres aim to bridge the digital divide by providing people access and knowledge about information technologies. A global telecentre movement is growing right now. Unfortunately, even where computer facilities are readily available, the digital divide persists—even in the world's most wealthy countries, access to the latest and most beneficial technologies is limited for those in rural areas and people with disabilities.

3.3.2   Relegation of some Useful Indigenous Knowledge

The advent of modern technology is largely thought by many agricultural experts to have impeded the development of local and indigenous knowledge in the fields of agriculture in Nigeria. The usefulness of this indigenous knowledge is however all encompassing as it is the basis for agriculture, health care, food preparation, education, environmental conservation and a host of other activities. Indigenous knowledge is also thought to be relatively advantageous in terms of economic resource of capital, land, and labour.

4.0   CONCLUSION

This unit has enabled you to understand that technological change can be a double-edge sword given its positive and negative influences on Nigerian agriculture. This further corroborates the essence of guiding principles for technology transfer process and the need for extension practitioners to pay careful attention to them in order to minimise the undesirable influence and promote the realisation of the desirable ones.

5.0 SUMMARY

In this unit, you have learnt that:

- The early applications of technology have not only increased food production in real terms, but have dramatically reduced the number of individuals directly involved in food production/processing – enabling the diversification of society to address social issues not directly related to "survival", but generally seen to increase the quality of life.
- The introduction of science and technology into agriculture has helped in the planning and implementation of agricultural development programmes in a scientific way reduced the heavy dependence on rain fed agriculture and enhanced the integration of development communication to agricultural practices.
- Access to the latest and most beneficial technologies is limited for those in rural areas and people with disabilities.
- The advent of modern technology is largely thought by many agricultural experts to have impeded the development of local and indigenous knowledge in the fields of agriculture in Nigeria.

6.0 TUTOR-MARKED ASSIGNMENT

i.   Explain the influence of technological change on agricultural productivity.

ii.   Discuss how technological change has helped stabilise food production and regular market supplies in Nigeria.

iii. In what ways has technological change imparted negatively on agricultural development in Nigeria?

7.0 REFERENCE/FURTHER READING

Paul, C. (2007). "A Framework for Understanding Technology and Technological Change." *The Public Sector Innovation Journal*, Volume 11(1), Article 3.

Í

UNIT 2   AGRICULTURAL EXTENSION AS A SOURCE OF TECHNOLOGICAL CHANGE

CONTENTS

1.0   INTRODUCTION

The purpose of extension is to aid the spread of useful and practical information to the farmers and their families on subjects relating to agriculture. Agricultural extension work is spread throughout the modern world because in the long run, no country can afford to neglect its rural population which produces the bulk of its food and fibres. Considerable development has been achieved in Nigerian agriculture in the past few years through an improvement in agricultural practices in the rural areas in terms of technology, farm inputs and infrastructure courtesy of agricultural extension efforts. This unit provides insights into the pivotal roles extension plays in technological revolution especially in Nigerian agriculture.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- explain how agricultural extension promotes rural and agricultural transformation through the vehicle of technological revolution
- discuss your expectation as an extension practitioner includes the promotion of technological change.

3.0   MAIN CONTENT

3.1   Concept of Extension Education

The term extension education was first used in 1873 by the Cambridge University to describe a particular educational innovation, the aim of extension then was to take the educational advantage of the university to the ordinary people where they lived and worked. However, it was argued that extension education was first coined in England and not America.

Agric extension is taken to mean extension education which supplies information on agriculture and the sources of the information /idea may include apparently indigenous national programmes that are syntheses of international ideas adapted to meet the local peculiarities. The purpose of extension is to aid the spread of useful and practical information to the farmers and their families on the subject relating to agriculture. Agricultural extension has spread throughout the modern world solely for rural development and improvement in the standard of living of the farm family.

According to William (1972), agricultural extension is an out of school system of education for teaching farmers how to raise their own standard of living by their own efforts and using their own resources by providing them with scientific knowledge to solve their problems. It is a two way method of taking proven practices to improve their productivity and at the same time bringing farmers problems back to research for solution. In turn the solution developed by research is passed back to the farmers. While extension work is educational, it is essentially voluntary and is directed to the practical problems by working with the farmers of different educational background, attainment and range of interest.

Agricultural extension has also been defined differently by different authors. Adams (1982) defined agricultural extension as that educational service which involves helping the farmers to identify, analyse and deal with their production problems. However, this definition seems not accurate because it excludes the idea of extension as a means of improving the social and educational standard of rural life. According to Legan (1968), extension is the primary means through which farmers learn about change, the reason for it and its value, the result it can achieve, the process by which it is achieved and also uncertainties inherent in it. Legan's definition explains change but did not specify the kind of change as to whether the change is in a way of standard of living or educational standard. Lyon

Í

(1949) defined agric extension as the term used to describe the complex of process by which rural people are persuaded to adopt improved farming methods and improved way of life.   According to Saville (1965), the aim of all extension work is to teach people living in rural areas how to raise their standard of living by their own effort using their own resources, manpower and material with minimum assistance from government. By encouraging local leadership and self-help, extension develops civil pride and the progressive growth of the community.

If agriculture is to be given the pride of place in development, agric extension must be seen as a way out. Agricultural extension must be seen as a service or a system which assist farm people through educational procedures in improving farming method and techniques, increasing production efficiency and income, improving the standard of living and lifting the social and educational standard of rural life.

One thing that is common to these definitions is that they all involve changes in the behaviour of rural people presumably resulting in improved agricultural production, better standard of living and the strengthening of national economy.

3.2   The Goals of Extension

Major objectives of extension include:

i)   to promote an understanding of rural problems
ii)   to develop understanding and appreciation of rural values
iii)   to develop practical methods of solving rural problems
iv)   to make rural life more satisfying and livable
v)   to promote improved integration of farming and rural life with other activities and interest of the nation.

3.3   The Confluence of Extension Education and Accelerated Agricultural   Transformation

It is undisputable that agriculture is the bedrock of the Nigerian economy with the small-scale, resource-poor farmers accounting for over 90% of the food and fibre produced in the country. It is also known that most of the crucial farming populations are illiterate and they reside in the rural areas with little or no social amenities as may be obtainable in the urban centers.

Available evidence clearly indicates that proper adoption and utilisation of improved technologies is fundamental for the realisation of increased

productivity levels and the subsequent transformation of the agricultural sector of the national economy of most nation-states. However, these improved technologies that are developed in the research institutes and universities must not only be transmitted to the farming population in their rural communities, but also delivered in that language that the farmers would understand. Herein lays the importance of agricultural extension as an integral part of the educational process designed to assist farmers to help themselves in realising the necessary improvements in their well being and quality of life.

Extension education has been clearly analysed to encompass the transmission of knowledge and skills to the rural dwellers through modes that are outside the regularly organised school and classroom for the attainment of socio-cultural and economic development. Extension education is therefore, aimed at developing the social behaviour of people, their different social groups, and the intra- and inter-relationships of these social groups.

3.4   Agricultural Extension and Technological Change

The importance of agricultural extension in pursuing increased production in agriculture cannot be overemphasised. As stated earlier, the surest way of increasing the traditional farmers' production is for the farmers to embark upon and continue to use improved methods of production (techniques and materials) from time to time. However, the farmers and the innovators or discoverers of improved methods of production are each of opposite extreme ends without perfect knowledge of the language and experience of the other. This makes it difficult for farmers to enjoy the benefits of the creative work done by the scientists and researchers.

Nevertheless, there is a process by which this gap could be filled. This is through agricultural extension services. The job of agricultural extension is handled by specialists trained to effect transfer of knowledge and skills from inventors to users. Without this group of people, the Nigerian farmers would be in a situation of "people suffering in the midst of plenty" technology wise.

4.0   CONCLUSION

This unit has enabled you to understand that the promotion of change in the behaviour of rural people presumably resulting in improved agricultural production, better standard of living and a strengthening of national

economy is the recurring decimal common to all definitions of agricultural extension by the various experts. These changes cut across all aspects of life of the rural people significant among which is technological change.

5.0 SUMMARY

In this unit, you have learnt that:

- Extension is the primary means through which farmers learn about change, the reason for it and its value, the result it can achieve, the process by which it is achieved and also uncertainties inherent in it.
- Proper adoption and utilisation of improved technologies is fundamental for the realization of increased productivity levels and the subsequent transformation of the agricultural sector of the national economy of most nation-states.
- The farmers and the innovators or discoverers of improved methods of production are each of opposite extreme ends without perfect knowledge of the language and experience of the other. The process by which this gap is filled is through agricultural extension services.

6.0 TUTOR-MARKED ASSIGNMENT

i. Present 3 different definitions of agricultural extension that you know.
ii. List the goals of extension education.
iii. Briefly explain how agricultural extension facilitates technological change.

7.0 REFERENCE/FURTHER READING

Veerabhadraiah, K.A.J. (2007). *Fundamentals of Extension Education and Management in Extension.* Concept Publishing Company.

Í

UNIT 3   PRINCIPLES OF AGRICULTURAL EXTENSION

CONTENTS

1.0   INTRODUCTION

A principle is a body of general knowledge or laws of a field of knowledge. An individual decides on certain principles to guide his life, these principles plays vital roles in deciding what is good or bad in the life of the individual. Furthermore, goals and means are decided on these basic principles of life of the individual. Farmers are no exception to this philosophical understanding of principles. This unit provides insight into the principles that guides the operation and delivery of extension services to the farmers.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- define the hypotheses upon which the operation of extension work is based
- discuss the operational guiding principles of extension service
- distinguish between what is the ideal extension practice/delivery system and what is not.

3.0   MAIN CONTENT

3.1   Important Facts for Extension Workers

Generally, extension education is based on the hypotheses that:

1.   Rural people are intelligent, are interested in obtaining new information and have a keen desire to utilise this information for

their individual and social welfare. The rural poor, peasant farmers and many progressive farmers are very intelligent.

2. People do not vary from their customary behaviour and habits unless they feel some need which their existing ways do not satisfy. Motivation can be stimulated through a degree of dissatisfaction.

3. Changes which do not involve vital matters are generally more readily accepted, at least are more apt to be tried. (When we start programmes, we usually do the simple things first).

4. But the most important advances usually do involve vital matters, and therefore cannot be the first objective to tackle.

5. Successful extension operation, coming through group activity, will cause a change in the social pattern.

6. People will in general know and understand less about a practice or other new activity than the "one and only" practice or change. This helps develop the choice making opportunity for the people, gives the impression of less pressure, requires less "hard sell" techniques, keeps failure to a minimum and saves face.

7. People will in general know and understand less about a practice or other new activity than they will admit or that the extension worker thinks they do. Extensionists must be willing to repeat and repeat and be patient with people as they grope along the uncharted route leading to local programme development.

8. Extension must recognise the attitudes about its work and activities. In general there are two:

   (a) The extension workers attitude; that change is desirable and the people ought to want it and want to know all about it.

   (b) The people's attitude; usually indifference. This indifference is usually through lack of knowledge. If extension workers can encourage the leaders to be receptive, then we can move the people from indifference to receptivity.

9. The basic philosophy of extension is directed towards changing the outlook of man by educating him. As stated earlier, compulsion does not persuade the people to walk in a particular way, the only way to secure the intelligence and whole hearted cooperation of a person is to educate him. Education is not a mere transfer of information, it is more than that. Its primary aim is to transform the people by bringing about desired changes in their knowledge, attitude and skills. If this had not happened, then, the activities chosen for extension are not educational and its effect cannot be long lasting.

3.2   Principles of Agricultural Extension

The extension work is based upon some working principles and the knowledge of these principles is necessary for an extension worker. Some of these principles, as related to agricultural extension, are mentioned below.

1.   *Principle of democracy*: Extension has as its foundation the philosophy of democracy, that is, the development of the people, by the people and for the people. Extension should not be coercive. A democratic approach is used in which people are reached by educational methods to solve their problems. Extension workers should therefore have faith in the democratic values and should try to educate farmers and not force them.

2.   *Principle of self-help*: Extension work is developed on the philosophy of helping the rural people to stand on their feet. The rural people are to be helped in understanding their natural resources and the ways of utilising these resources for development. By utilising these resources, they can lead a satisfactory life. Due to this reason, the extension worker has to start from the level of the local people and help them in utilising their resources for the betterment of the individuals and community. Extension programme should be oriented to the existing technical, economy and social level of the people.

3.   *Extension work should be based on careful analysis of factual situation* i.e. all relevant available facts about land, people, homes, custom, community, organisation, institution, local leaders and environment. This will help the extension worker unravel the gap between where the people are and where they ought to be. It will also guide his/her activities to ensure they do not conflict with the people's interest.

4.   *Principle of interest and need:* Extension work must be based on the needs and interests of the people. These needs and interests differ from individual to individual, from village to village, from block to block, and from state to state. Therefore, there cannot be one programme for all the people.

5.   *Principle of cultural difference:* Extension work is based on the cultural background of the people with whom the work is done. Improvement can only begin from the level of the people where they are. This means that the extension worker has to know the level of the knowledge, and the skills of the people, methods and tools used

by them, their customs, traditions, beliefs, values etc. before starting the extension programme.

6   Principle of participation*:* Extension helps people to help themselves. Good extension work is directed towards assisting rural families to work out their own problems rather than giving them ready-made solutions. Actual participation and experience of people in these programmes creates self-confidence in them and also they learn more by doing.

7   Principle *of adaptability:* People differ from each other, one group differs from another group and conditions also differ from place to place. An extension programme should be flexible, so that necessary changes can be made whenever needed, to meet the varying conditions.

8   The grass roots principle of organization: A group of rural people in local community should sponsor extension work. The programme should fit in with the local conditions. The aim of organising the local group is to demonstrate the value of the new practices or programmes so that more and more people would participate.

9   *The leadership principle:* Extension work is based on the full utilisation of local leadership. The selection and training of local leaders to enable them to help to carry out extension work is essential to the success of the programme. People have more faith in local leaders and they should be used to put across a new idea so that it is accepted with the least resistance.

10   *The whole-family principle:* Extension work will have a better chance of success if the extension workers have a whole-family approach instead of piecemeal approach or separate and un-integrated approach. Extension work is, therefore, for the whole family, i.e. for male, female and the youth.

11   *Principle of co-operation:* Extension is a co-operative venture. It is a joint democratic enterprise in which rural people co-operate with their village, block and state officials to pursue a common cause

12   *Principle of satisfaction:* The end-product of the effort of extension teaching is the satisfaction that comes to the farmer, his wife or youngsters as the result of solving a problem, meeting a need, acquiring a new skill or some other changes in behaviour. Satisfaction is the key to success in extension work. A satisfied customer is the best advertisement.

13   *The evaluation principle:* Extension is based upon the methods of science and it needs constant evaluation. The effectiveness of the work is measured in terms of the changes brought about in the knowledge, skill, and attitude and adoption behaviour of the people but not merely in terms of achievement of physical targets.

14.   *Principle of total package*: Extension programme should be comprehensive catering for all categories in the community i.e. the adult, young and children, the males and females etc. Extension service delivery should also take into consideration all the aspects of life of farm families including home economics, family planning, education, marketing of farm produce etc.

4.0   CONCLUSION

This unit has enabled you to understand the guiding principles for the operation and delivery of extension services and to distinguish between what is the ideal extension practice and what is not. Above all, you have learned that the basic philosophy of extension is directed towards changing the outlook of man by educating him.

5.0   SUMMARY

In this unit, you have learnt that:

- extension workers must be willing to repeat and repeat and be patient with people as   they grope along the uncharted route leading to local programme development
- compulsion does not persuade the people to walk in a particular way, the only way to secure the intelligence and whole-hearted cooperation of a person is to educate him. Extension workers should therefore have faith in the democratic values and should try to educate farmers and not force them
- extension work must be based on the needs and interests of the people
- actual participation and experience of people in extension programmes create self-confidence in them and also they learn more by doing.

6.0   TUTOR-MARKED ASSIGNMENT

i.   Briefly explain the importance of principles in extension service delivery.
ii.   Mention two important hypotheses of extension work.
iii.   List 10 principles of agricultural extension and explain any two of them.

7.0   REFERENCE/FURTHER READING

"*Agricultural Extension Education*"

(http://www.krishiworld.com/html/agri_extension_edu1.html)

Í

UNIT 4 ROLES OF AGRICULTURAL EXTENSION IN AGRICULTURAL DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

The need for adoption of Agricultural Extension System for increased productivity cannot be overemphasised. The world population in 1900 was 1 billion; it became 2 billion by 1930, 3 billion by 1960, more than 6 billion by 2000 AD. It is expected to touch more than 12 billion by 2030. However, in order to feed these billions the food demand will be in the order of 31000 billion tons at the rate of 250 kg of cereal per capita and the world has already surpassed this figure. Still hunger haunts the human race. The reason is not then the shortage but lack of purchasing power. In fact food is used as a weapon by the developed countries. It should have been the task of mankind to assure the people of this world at large of their right to be free from hunger through increased production. Increased agricultural production can be brought about by advocating the advanced scientific knowledge to bring about changes in the production standards of those areas where the potential is not fully exploited to the level the science has achieved today.

Extension education is the only means through which the desired transformation can be brought about in the agricultural land productivity of the farming community. It is in this perspective that technology development (through research) and technology transfer (through extension and education) have been identified as key inputs indispensable for developing and sustaining a productivity led agricultural sector. Yields are the eventual consequences of developmental efforts, and extension impact would be reflected more in yields than in other measures.

Í

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- discuss the challenge of agricultural and rural development in Nigeria
- outline the relationship between agricultural and rural development
- state your expected roles as a change agent in fast-tracking agricultural development in Nigeria.

3.0 MAIN CONTENT

3.1 Rural and Agricultural Development: The Nexus

Rural development is a strategy used to improve the economic and social life of those who stay and have their living in the rural areas. According to Mabogunje (1981), rural development is concerned with improvement of the standard of the living of the low income population living in the rural areas on a self sustained basis through transformation of the socio-spartial structure of their productive abilities.

Okuneye and Idowu (1990) defined rural development as identifying the needs of rural community, assessing its resources and potentials with a view to formulating strategies which will improve the existing level of productivity and well-being of the populace. Furthermore, they argued that whatever the dynamic nature of development strategies, certain basic fundamental needs of the population must be met. These include health, education, housing, extension services, communication, infrastructures and transportation. It also includes storage, marketing and other facilities required for day to day activities of the rural populace. In his own contribution, Cirdap (2008) defined rural development as a set of policies aimed at the promotion of the well-being of the rural majority and the production of the surplus that will enable the non rural populace to make a living.

Rural development is often used to mean increase in agricultural production and productivity. This has been the major orientation of rural development in Nigeria. Rural development by this definition is synonymous with agricultural production/development. The question is: is agriculture the only occupation available in Nigeria? Abassi Ekong (1982) provided answer to the question when he asserted that while agricultural development represents the main component of any successful rural

programme simply because about 80% of the third world rural population engages directly or indirectly in agricultural productivities. Rural development must thus be viewed in terms of balanced economy and social development with emphasis on the content of far reaching transformation of economic and social structures installation and relationship as in the rural areas.

3.2   Roles of Extension in Agricultural Development

1.   *Dissemination of the information relating to advanced technology in agricultural production*: This includes usage of improved seeds, methods of use of chemical fertilisers etc. to the farmers. Research findings will be meaningless unless they are accepted by the farmers. The results of agricultural research are made available to the farmers through the network of extension system. Farmers are intelligent enough to adopt those technologies, which are beneficial and bring economic return.

2.   *Provision of link between research and farmers*: Agricultural extension provides the healthy coordination that is needed between farmers and research institutions in a more effective way. They also bring back the farmers problems back to the research for analysis and possible solutions. In order to perform this function, proper and effective lines of communication must exist between the research system and the extension agent. The extension agent must also understand properly the nature of the technology. This therefore implies that the extension agent must be knowledgeable in all subject matters related to agriculture and be skilled in the act of communication process.

3.   *Educational input*: Extension teaching is the process through which the extension workers stimulate interest in learning more by using various teaching methods, tools and techniques to improve the situation. This knowledge and skill should be so applied by the extension worker so as to arouse in them the interest to adopt the advanced scientific technology in their day-to-day practice. Agricultural extension involves both learning and teaching methods as it forms an educational process for bringing about the maximum number of people within the fold of desirable changes in them. The essential role of agricultural extension workers is to create an effective learning situation. Most effective learning situation requires the following elements:

a.   Instructor: The village level worker (Extension worker) with the information on scientific knowledge;

b.   Learner: Farmer, Farm women and the village youth, the target group;

c.   Subject matter: Advanced scientific knowledge such as the practices of cultivation of hybrid varieties of seeds, fertilizers, its planned use, pesticides, improved implements, land and water management system etc;

d.   Teaching aids: Such as charts, models, samples, slides, film shows, flannel boards, flip charts etc;

e.   Physical facilities: these include places where farmers could sit around or go around for practical studies.

4.   *To get farmers to a frame of mind and attitude conducive for acceptance of change:* This is because most farmers in Nigeria today are still tradition bound and therefore afraid to take costly risk unless they are convinced beyond doubt that what the extensionist is asking them to take is safe, economically viable and will not violate their rule.

5.   *To help farmers make the wise decision in farm management*: For the subsistence farmers, this is a major assignment because the farmer has to operate in a modern economic condition where prices and factors of production will have to be taken into consideration. The farmer may not know how to combine the factors of production to enable him make wise decision. Extension is an important tool in assisting the farmer to provide proficiency in the management of his farm having regard to the resources available to him.

6.   *Rural vacuum filler*: This implies that extension workers need to do that which is to be done by someone else but has not been done and which could be locally done to make greater agricultural productivity possible.

7.   *Extension also needs to ensure that channels of communication are well defined:* This is to ensure that improved practices are culturally compatible, technologically feasible and economically profitable. The concept of development communication and developmental organization has been successfully introduced in Nigeria though the efforts of extension education.

8.   *Stimulating local group action.* Focusing on agricultural support activities

9.   *Overall improvement of the quality of life of the rural people* : This is achievable within the framework of the national economic and social policies as a whole.

10**.**   *Agricultural extension plays an important role in introducing science and technology:* Through agriculture to the vast rural communities and to help them plan and implement agricultural development programmes in a scientific way. In other words,

extension helps the farmers to think and act more on scientific lines rather than the traditional way of thinking and acting.

11. *Agricultural extension should enable faculties of agriculture and research institutes and also agricultural universities extend their frontier:*. Focus on this should be beyond their four walls and take a hard look at the real life situation faced by farmers in the rural areas.

4.0   CONCLUSION

The essence of agricultural extension is that it works with the rural people and their problems, transmitting information, expressing the way people think about their problems to   the research institution and bring solution to the problems back to the people. You have also learned that extension helps in fostering and encouraging organisations like cooperatives, farmers' organizations and marketing associations into action that will further enhance agricultural support activities.

5.0   SUMMARY

In this unit, you have learnt that:

- rural development is often used to mean increase in agricultural production and productivity and therefore rural development is synonymous with agricultural production/development
- the extension education is the only means through which the desired transformation can be brought about in the agricultural land productivity of the farming community
- technology development (through research) and technology transfer (through extension and education) are key inputs indispensable for developing and sustaining productivity led agricultural sector
- yields are the eventual consequences of developmental efforts, and extension impact would be reflected more in yields than in other measures
- extension agents must be knowledgeable in all subject matters related to agriculture and be skilled in communication.

6.0   TUTOR-MARKED ASSIGNMENT

i   Rural development is synonymous with agricultural development. Explain.

Í

ii   Explain 5 important roles of agricultural extension in agricultural development in Nigeria.
iii   Mention 5 important elements of effective learning situation.

7.0   REFERENCE/FURTHER READING

"Agricultural Extension Education"

 (http://www.krishiworld.com/html/agri_extension_edu1.html)

Í

MODULE 2

Unit 1   Technological Change and Societies
Unit 2   General Principles in Introducing Technological Change in Nigerian Agricultural development
Unit 3   Factors to be considered in Introducing a Technology into a Community.

UNIT 1   TECHNOLOGICAL CHANGE AND SOCIETIES

CONTENTS

1.0   Introduction
2.0   Objectives
3.0   Main Content
        3.1   Introducing Change into a Society: Impeding Forces
        3.2   Transfer of Technology
               3.2.1 Reasons for Failure of Transfer of Technology
               3.2.2 Factors Affecting Technology Transfer at Village Level
4.0   Conclusion
5.0   Summary
6.0   Tutor-Marked Assignment
7.0   References/Further Reading

1.0   INTRODUCTION

Insights into the interrelationship between technological change and societies are proposed through this paper as one small contribution to a larger body of theorising. It can be seen as an observational map to help practitioners, whether field practitioners or donors, including the people they are attempting to assist, to read and thus navigate processes of social change. There is a need to observe and understand the change processes that already exist in a living social system and the influence of technology. If we can do this before we rush into doing our needs analyses and crafting projects to meet these needs, we may choose how to respond more respectfully to the realities of existing change processes rather than impose external or blind prescriptions based on assumed conditions for change.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- acquire knowledge on how to maintain a balance between positive and negative forces militating against technological change in societies
- discuss reasons for failure of transfer of technology in our local communities
- develop competencies on the know-how of efficient and effective technology transfer process.

3.0   MAIN CONTENT

3.1   Introducing Change into a Society: Impeding Forces

Stories have shown that communities with neighbourhoods that are ethnically heterogeneous tend to have significantly larger farm practice adoption plots than homogeneous ones.   This may arise from interaction which spurs competition between the communities and eventually expands farming scopes. When a high status farmer comes to a lower one the latter usually internalises some of the practices of the superior farmer and thus gets better. There is a change inertia which may be blocked simply by human inactivity or lethargy until this is challenged through personal desire.   People have to devise change before they adopt and "it is difficult to teach an old dog a new trick". This is because habits become fixed as one gets older and this may clog the wheel of change when closely connected to folk culture/custom when a deviation from the norm may mean alienation from family or community.

Some people fear change and are suspicious of change agents because they are anxious about life and survival. Such fear is often rooted in the level of perceived vulnerability of the individual and makes them continue with life mainly as a routine activity. And when inevitable change comes to the society there are social forces that militate against it.

Vested Interest: - Social change is often more directed to a group than others which imply that the benefit of the change is uneven. This leads to resistance when it threatens vested interest of key individuals or groups. E.g. the takeover of schools by government through the Universal Basic Education (UBE) brings about educational equality. The fact is that some individuals are simply satisfied with the status quo especially if they are favoured.

Í

Rejection of Outsiders: - People naturally suspect strangers and will tend to resist changes originating from them. At national level, change may be rejected if found unfriendly by a nation.

Kurt Lewin realised the implication of all the above factors to successful introduction of change and came up with the FIELD THEORY which posits that social behavior characteristically requires a balance between positive and negative forces. To introduce change, an agent must attempt to reduce negative forces in the field situation following this process:

1.   Unfreeze the society i.e cause a sort of imbalance by educating the leaders. This will enhance their aspiration and desire for change.
2.   Introduce the change.
3.   Re-freeze the society: This is not easy but can be done by reinforcing the positive values i.e. introduce all necessary supportive facilities that will keep the innovation going.
Some people criticise this in that it looks easy to brainwash a society into accepting what they do not really need.

3.2   Transfer of Technology

As a way of social change, technology within a social system is a vital tool as it impinges on livelihood, culture and social institutions. Technology is often linked with science which is described as application of knowledge of nature for achievement of goals. Technology is usually integrally related to the social structure of a society i.e. people's statuses and roles are somehow dependent on technology. The indigenous technology usually fits the environment, economy, social structure, culture and psychology of the system that it originates in.   When it does not fit, either the technology or the system will change.

The system of production of a society is the basis of all other institutions in the society and this is related to the level of scientific knowledge and its application. For instance, the wheel was first used in Europe and it led to the adoption of many innovations including animal traction which influenced agriculture in no small measure: large farms, high productivity/man, and high value of land, hence permanent ownership of land and the political structure became based on land ownership.
 In Africa, opposites of the above occurred and land use rights were adopted instead of permanent ownership and the political system was based on people rather than land.

Transferred technology is one that moves by plan from one place to another i.e. directed change. Some things however move into a system without plans e.g. torchlight, toothbrush. If transferred technology does not fit, it is rejected or the system has to make very large readjustments within it e.g. canned meat.

The idea of developing another country by transferring technology become popular during World II during the Marshall plan – named after an American general who proposed the plan to rebuild Europe after the war. The plan was successful and the result is the Europe of today. The success was because everybody involved wanted to rebuild Europe i.e. there was a shared goal between the Americans and Europeans. Furthermore, the receivers were similar in culture to the donors (in terms of culture) at least along technology, so the receivers did not have to learn new technological skills. Also, the production pattern that was transferred did not require much change in the social organisation of the system and it was largely a reacquisition of what they had. The control of the technology was in the hands of Europeans. The war ended in 1945 and by 1960, Europe was competing which America.

This success made people think it possible to develop other countries. The imperialists then used this idea to transfer technology to their colonies in the '60s. Most of the efforts were not successful.

3.2.1 Reasons for Failure of Transfer of Technology

- Different goals: The receiving system wants a technology to bring independence, modernity, and prosperity. The donors do not want receivers to be lifted up and only want to create supplies of what they need and markets for what they produce e.g. some countries did not want Nigeria to have steel mills so as to make it a dumping ground for steel products.

- Control of technology: Technology is usually taken as a preserved belonging of the sources and thus the exclusive control is vested in them. The owners determine how far and how much the receiver system can use the technology by retaining production of spare parts and other components. The technology can only be viable as long as it serves the goal of the owners with less concern for the receiver system. This issue can be related to the availability of technology to users or creation of feedback from users e.g. provision of tractors for farmers yet they cannot determine when they will have access to it, or when users are

totally helpless when a technology breaks down. Control of technology therefore becomes an issue if the receiver system will fully benefit from the technology and it often leads to indigenisation decrees or compulsory stock acquisition.

- Social – Economic Environment of Donors Receivers: The technology that suits one environment may not suit the other. There can even be differences between environments within a country. It is therefore necessary to identify the systems and to make sure the technology will fit into the environment.

3.2.2 Factors Affecting Technology Transfer at Village Level

Food shortages, pollution of air and water, soil erosion and rapid industrialisation are but a few of the many problems facing mankind. Abuse of earth's lands, accompanied by un-programmed world's population growth has put unmanageable pressure on natural resources. Technology transfer is facing enormous challenges in dealing with all these problems. The need for new technology transfer approaches arises from the new demands imposed by the huge population increase and the new concept of sustainable development. Strengthening technology transfer institutions, enhancing participation, as well as improving resource management, would reinforce sustainable development by balancing the three major components: environment, social, cultural and economic factors. The future of technology transfer would depend largely on its capacity to implement economic, social, cultural and environmental policies that would create the basis for sustainable development. The success of technology transfer thus begins with the sustainable use of the technology among the populace but this is contingent upon a variety of factors that are ostensibly hinged on the user's situation which can be classified as: Environment, Economic, Social, Cultural and Psychological.

- Environment Factors: This has to do with the scope of operation of the farmer which can be described as peasantry in nature, undertaking subsistence production and located in traditional setup, are seldom completely self sufficient i.e. often dependent on other people or organisation. With other predisposing factors which may include physical environment, desire for and decision to change becomes a major challenge even before understanding the change itself.

- Economic Factors: This sets the absolute limit to technology transfer and it begins with the volume of activity and market orientation which in itself determines the drive to maximise productivity and thus readiness to adopt means of enhancing yield.   Also, the idea of profit which is universally understood is needed. Stability of prices of inputs and outputs become important as well as this enables projection and guarantees investment. Value addition, preservation and utility of products further reinforce diversification of activities and additional means of revenue. When there are incentives for attacking bottlenecks in the system, for example, right for land, market availability, tractor availability, herbicide, mechanisation and even improvement of feeder roads, then a good basis for technology transfer is provided. Capital formation to assist in procuring technology is another way of enhancing transfer. E.g. In a closed system, the only available capital is self help so assistance may have to come from other sources if things are to be bought.

- Social Factors: Social Factors like geographic proximity of the benefiting community can enhance technology transfer, and the cost associated with maintaining the technology in operation will be less if the transacting parties are contiguous to one another. The effects of geographical location on technology transfer can be seen from two different perspectives. First, if natural resources or new materials needed to produce certain products through the application of the new technology do not exist because of geographic conditions, this will directly affect the applicable technology. Second, the geographical location lacks one or more key ingredient(s) necessary to make the technology transferable, such as the lack of a plentiful water supply vital to a technological process, even though all of the other necessary raw materials are available

- Cultural Factors: Technology transfer contributes to long-term sustained agriculture only if there is an active interaction between individuals, societies and communities. In any interaction between them, there is an element of culture and ignoring any while promoting technology transfer may produce unwanted results. Culture is one of the most powerful factors affecting the success of technology transfer. Tradition, religion, historical habits, and personal aspirations for a new life are important factors facing technology digestion and absorption. Barriers to a successful technology transfer include cultural and language gaps, low technical and other capabilities in rural communities, inadequate infrastructure in developing countries, and insufficient investment in research and development, particularly relating to

technology adaptation. For instance, one of the major concerns in managing an international technology transfer (TT) is the potential communication difficulty that could arise because of the cultural differences between the technology provider and the technology receiver. Cultural differences might not only impose barriers for technical communication but also have an interaction effect with the nature of technology. In order to have a successful transfer, transferees should choose a more mature and codified technology, and a relatively inexperienced transferor with a similar culture.

- Psychological Factors: While there are numerous models for technology transfer into different communities, there is also a growing body of information that human factors play a very significant role in determining the success or failure of technology transfer and commercialisation ventures. Using social cognitive theory, it is believed that prior experience with technology and mechanical competence were two influential factors that affected successful transfer and had a positive influence on its outcomes. Also, Carlla and Chong (2009) in their research on "Reverse knowledge and technology transfer: imbalances caused by cognitive barriers in asymmetric relationships" identified psychological factors that impact on technology transfer process as including: psychological contracts, perceived lack of procedural justice, a lack of intrinsic motivation, psychic distance and liability of foreignness. Based on their findings, the following propositions were made:

- For full and effective knowledge transfer to occur the transfer process must be seen to be procedurally just.
- For full and effective transfer of tacit knowledge to occur, there must be intrinsic motivation in all concerned.
- The difficulty of reverse knowledge transfer increases with the psychic distance between subsidiaries and headquarters within the same corporation.
- The difficulty of reverse transfer of knowledge increases with greater relative social embeddedness of local subsidiaries.
- The difficulty of reverse transfer of knowledge increases where there is a liability of foreignness.

4.0   CONCLUSION

This unit has enabled you to understand how to better manage a social system for effective and efficient technology transfer process.

5.0   SUMMARY

In this unit, you have learnt that:

- when inevitable change comes to the society there are social forces such as vested interest and rejection of outsiders that militate against it
- the idea of developing another country by transferring technology became popular during World II during the Marshall plan – named after an American general who proposed the plan to rebuild Europe after the world war.   The plan was successful and is the Europe of today
- technology fails for various reasons which include different goals, control of technology and Social – Economic Environment of Donors/Receivers
- the success of technology transfer begins with the sustainable use of the technology among the populace but this is contingent upon a variety of factors that are ostensibly hinged on the user's situation which can be classifies as: environment, economic, social, cultural and psychological.

6.0   TUTOR-MARKED ASSIGNMENT

What is do you understand by Kurt   Lewin Force Field theory of social system.

i.   Explain how you will apply Kurt Lewin theory for successful change initiation in a rural community.
ii.   Mention 5 and explain any 2 factors that may affect technology transfer at village level.

7.0   REFERENCES/FURTHER READING

Alrusheidat, J. (2009)."The Impact of Cultural Dimensions on Technology Transfer in Developing Countries." *Journal of Food, Agriculture and Environment,* Volume 4.

Bou-Wen, L. & Daniel, B. (2001). "Factors Affecting Technology Transfer." *International Journal of Project Management* Volume 19, Issue 5, Pages 287-293.

Carla, C.J. Millar, M. & Chong, J.C. (2009). "Reverse Knowledge and Technology Transfer: Imbalances caused by Cognitive Barriers in Asymmetric Relationships". *International Journal of Technology Management,* Vol. 48, No. 3, 2009.

http://www.ashridge.com/Website/IC.nsf/wFARATT/Reverse Knowledge

Í

Dayanatha, J.H.A. (N.D.) "Indigenous Technology and Agricultural Research System." *National Centre for Agricultural Economics and Policy Research, New Delhi* - 110 012.

Doug, R. (2008). "A Theory of Social Change and Implications for Practice, Planning and Evaluation."

(www.cdra.org.za/A*)*
http://ageconsearch.umn.edu/bitstream/47353/2/1-D-Jha.pdf

UNIT 2   GENERAL PRINCIPLES IN INTRODUCING TECHNOLOGICAL CHANGE IN NIGERIAN AGRICULTURAL DEVELOPMENT

CONTENTS

1.0   INTRODUCTION

Success at large-scale transformation demands more than the best strategic and tactical plans, the traditional focus of many technology transfer agents. It requires an intimate understanding of the human side, as well as — the community's culture, values, people, and behaviour that must be changed to deliver the desired results. Plans themselves do not capture value. Value is realised only through the sustained, collective actions of thousands or tens of thousands of clients who are responsible   for executing, and living the change. Technological change management is a basic skill in which most leaders and extension workers need to be competent. There are very few environments where change management is not important. This unit takes a look at the basic principles of managing technological change process and provides some tips on how those principles can be applied.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- state the guiding principles for successful technological change management
- discuss the human and community characteristics that must be changed to deliver the desired results in technological change process
- develop competence in the basic skills required for introducing technological change to an agricultural community.

33

3.0   MAIN CONTENT

3.1   Tips to Apply when Managing Change

When leaders or managers are planning to manage change, there are five key points that need to be kept in mind:

- different people react differently to change.
- everyone has fundamental needs that have to be met.
- change often involves a loss, and people go through the "loss curve"
- expectations need to be managed realistically
- fears have to be dealt with.

Here are some tips to apply when managing change:

- give people information - be open and honest about the facts, but do not give overoptimistic speculation. I.e. meet their openness needs, but in a way that does not set unrealistic expectations
- for large groups, produce a communication strategy that ensures information is disseminated efficiently and comprehensively to everyone (do not let the grapevine take over). e.g.: tell everyone at the same time. However, follow this up with individual interviews to produce a personal strategy for dealing with the change. This helps to recognise and deals appropriately with the individual reaction to change
- give people choices to make, and be honest about the possible consequences of those choices. i.e. meet their control and inclusion needs
- give people time, to express their views, and support their decision making, providing coaching, counseling or information as appropriate, to help them through the loss curve
- where the changes involves a loss, identify what will or might replace that loss - loss is easier to cope with if there is something to replace it. This will help assuage potential fears
- where it is possible to do so, give individuals opportunity to express their concerns and provide reassurances - also to help assuage potential fears
- keep observing good management practice, such as making time for informal discussion and feedback (even though the pressure might seem that it is reasonable to let such things slip - during difficult change such practices are even more important).

3.2   Principles of Technological Change Management

1. **Address the Human Side of Change Systematically**

Any transformation of significance will create people issues. New skills and capabilities must be developed, new leaders will be asked to step up, jobs will change, and people will be uncertain and will resist. Dealing with these issues on a reactive, case-by-case basis puts speed, morale, and results at risk.   A disciplined approach to change management must be one of the four pillars of any transformation approach. This fact-based approach demands as much data collection and analysis, planning, and implementation discipline as a strategy, systems, or processes. It should be fully integrated into the programme design and decision making, both informing and enabling strategic direction. A formal approach for managing change-beginning with the leadership of the community and then engaging other key stakeholders-should be developed early but adapted often as change moves through the community.

2. Change Starts at the Top and Begins on Day One

Change is inherently unsettling for people at all levels of a society, and when it is on the horizon all eyes will turn to the leadership team for strength, support, and direction. The leadership must change first to challenge and motivate the rest of the society, speaking with one voice and walking the talk to model desired behaviour. At the same time, individual leaders are going through their own personal changes and need to be supported so that they can be all in agreement.

3. Real Change Happens at the Bottom

As transformation programmes progress through strategy/target setting, design, and implementation, they affect different levels of the society. Change efforts must include plans for identifying leaders and pushing responsibility for design and implementation down through the society. Strategy and target setting is usually the responsibility of the leadership team and its direct reports.

4. Confront Reality, Demonstrate Faith, and Craft a Vision

 Individuals are inherently rational and will question to what extent change is needed, whether the society is headed in the right direction,

and whether they want to personally commit to making change happen. They will look to the leadership for answers. Articulating a formal case for change and creating a written vision statement are invaluable opportunities to create leadership team alignment. Leaders must then customise this message for various internal audiences, describing the pending change in terms that matter to the individual farmer:

> confronting reality and articulating a compelling need for change
> demonstrating faith that the opportunity the society has is a viable future and the leadership to get there
> providing a roadmap to guide behaviour and decision-making.

5. Create Ownership, not Just Buy-In

Large technological change programmes require a distributed leadership that has broad influence over decisions. Change leaders must over-perform during the transformation and be the zealots that create critical mass for change in the workforce. This require more than buy-in or passive agreement that the direction of change is acceptable. It demands ownership by leaders willing to accept responsibility for making change happen in all of the areas they influence or control. Ownership is best often created by involving people in identifying issues and crafting solutions. It is reinforced by a combination of tangible (financial compensation) and psychological (camaraderie, sense of shared destiny) incentives and rewards.

6. Practice Targeted Over-Communication

The best-laid plans are only as good as the community's ability to understand, adopt, and act on them. Too often, change leaders make the mistake of believing that others understand the issues, feel the need to change, and see the new direction as clearly as they do. The best change programmes reinforce core messages through regular, timely advice that is both inspirational and actionable. Communication is both outbound and inbound. It should be targeted so as to provide beneficiaries of a new technology the right information at the right time, to solicit their input and feedback and to check in on their emotional response to what they have heard. Change programmes often require over-communication through multiple, redundant channels. However, communication must be timed, coordinated, consistent and personal. The best change leaders speak from the heart and convey a deep sense of personal commitment. They tell a consistent story and view telling the story as a key responsibility in the change process.

7. Explicitly Address Culture and Attack the Cultural Centre

Society's culture is an amalgam of shared history, explicit values and beliefs, and common attitudes and behaviors. Change programmes often

require amending, creating, retaining or merging culture to be successful. Culture should be addressed as thoroughly as any other area.
This requires developing a baseline through a cultural/societal diagnostic, defining an explicit end-state or desired culture, and devising detailed plans to make the transition. After completing the vision and thinking about the desired culture, leaders can assess the current culture to understand the gaps that need to be bridged and to identify strategies to accelerate the development of a new culture. Leaders should be explicit about the type of culture and underlying behaviours that will best support the new technology and find opportunities to socialise, model, and reward those behaviours. Attacking the cultural centre of a society – the locus of thought, activity, influence, or personal identification – is often an effective way to jump-start culture change for technological change.

8. Assess the Cultural Landscape Early

Successful change programmes pick up speed and intensity as they cascade down, making it critically important to understand and account for culture and behaviours at each level of society. Thorough cultural diagnosis can assess societal readiness to accept technological change, bring major issues to surface, identify cultural factors that will support or inhibit technological change, and target sources of leadership and resistance. They identify the core values, beliefs, behaviours, and perceptions that must be taken into account for successful change to occur. They serve as the common fact baseline for designing key change element, such as the new technology and building the infrastructure and programmes needed to drive change.

9. Prepare for the Unexpected

No change programme has gone completely according to script. People will react in unexpected ways, areas of anticipated resistance vary, areas of anticipated resistance will fall away, and the external environment will shift. Effectively managing technological change requires constantly reassessing the impact of change efforts and the society's willingness and ability to adopt the next wave of transformation.

10. Speak to the Individual as well as to the Society

Change is a personal journey as well as a societal one. It truly does affect one person and one team at a time. Individuals need to know how their work will change, what is expected of them during and after the change programme, how they will be measured, and what success or failure will mean for them. Be honest and explicit as possible. People will react to what they see and hear around them. Involve people in the

37

change process. Provide high visible rewards (such as recognition) as dramatic reinforcement for embracing change

4.0   CONCLUSION

Most extension workers managing technological change process know that people matter. It is all too tempting, however, to dwell on the plans and processes, which do not talk back and do not respond emotionally, than to face up to the more difficult, and more critical, human issues. These guidelines should help dispel some of the mystery of successfully mastering the soft side technological change.

5.0   SUMMARY

In this unit, you have learnt that:

- change efforts must include plans for identifying leaders and pushing responsibility for design and implementation down through the society
- in technological change process, the leadership must change first to challenge and motivate the rest of the society, speaking with one voice and walking the talk to model desired behaviour
- articulating a formal case for change and creating a written vision statement are invaluable opportunities to create leadership team alignment
- ownership is best often created by involving people in identifying issues and crafting solutions. It is reinforced by a combination of tangible (financial compensation) and psychological (camaraderie, sense of shared destiny) incentives and rewards
- the best change programmes reinforce core messages through regular, timely advice that is both inspirational and actionable
- successful change programmes pick up speed and intensity as they cascade down, making it critically important to understand and account for culture and behaviours at each level of society
- change is a personal journey as well as a societal one.

6.0   TUTOR-MARKED ASSIGNMENT

i.   Mention 5 important tips to apply when   managing technological change.
ii.   Explain 5 principles of technological change management.
iii. List 3 important stakeholders in technological change process.

7.0   REFERENCES/FURTHER READING

Booz, A.H. (2004).*Ten Guiding Principles of Change Management*. U.S.A: Booz Allen Hamilton Inc.

Robert, B.(N.D.). *Change Management Guide- People Factor*.

http://work911.com/managingchange/index.htm.

í

UNIT 3 FACTORS TO BE CONSIDERED IN INTRODUCING A TECHNOLOGY INTO A COMMUNITY

CONTENTS

1.0   INTRODUCTION

When introducing a new technology, it is particularly important to: identify factors that influence technology choice and potential use of new technology, understand users' attitudes towards new technology and other development initiatives, understand users' views on the service delivery system, identify the service delivery, training and management requirements for providing good-quality technology services and use the results of these enquiries to develop a strategy for introducing a new technology and eventually making it widely available. The knowledge of these is a necessary pre-requisite for success in any technology transfer process.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- identify factors that are crucial to transfer of a new technology
- discuss appropriate strategy for introducing a new technology to people you may be required to serve as an extension agent
- explain how to get your clients into a favourable mind-frame to accepting new innovation/technology.

3.0 MAIN CONTENT

3.1 Factors Affecting Introduction of New Technology

These factors are otherwise known as barriers that could militate against the successful introduction and adoption of a new agricultural technology to a community. Extension workers need to understand these factors and how to employ appropriate strategies to curtail the effect of such in order to get all the concerned stakeholders into a good frame of mind necessary for effective technology transfer process. These factors are summarised according to the following categories:

a.   client-related factors
b.   provider-related factors
c.   cultural factors
d.   product-related factors
e.   service quality- related factors
f.   method- related factors

3.1.1 Client-Related Factors

 Beneficiaries or community that an extension agent is introducing the new technology to. Client –related factors include:

-    lack of knowledge about the new technology
-    tradition-bound behaviour common especially among rural adults.

Some of these factors arise through other characteristics of the client and may be traced to the socio-economic milieu in which he operates. When an individual feels less secure, change is often feared as he/she considers the extent of 'safety net' available before venturing into an entirely new area. And for those entrenched in tradition and its systems of production, resources available are usually limited, leaving no room for adjustment or 'risk taking'

3.1.2 Provider-Related Factors

Lack of knowledge among providers, programme managers and policy-makers is an obstacle to the introduction of new technology in agricultural development programmes. Providers may:

•   not have a clear understanding of the role the new technology can play
•   may be reluctant to provide the new   technology because of:

- insufficient training
- personal biases
- their own beliefs or value systems
- providers may also be anxious about safety and risks.

The support of the providers is the commencement of technology transfer as this determines the active interest shown in the direction of the client. It will also determine the sequence in which the components of the technology will be transferred in a way to benefit and enhance adoption. The policy makers have the responsibility to shop for sustainable and beneficial technology for the target system.

3.1.3 Cultural Factors

- the influence of traditional religious groups who may oppose the innovation
- influence reflected by politicians, policy-makers, agricultural workers, local counselors and the media
- certain technology may be especially controversial since they may be wrongly perceived as taboo e.g. IUD and Emergency Contraception.

Technology transfer requires an understanding of the target system before it can occur. This will provide information about how the system operates including the value system, power structure and the amount of dislocation that will be expected as a result of its adoption. If job dislocation or other changes will be too drastic for the system to accommodate, then the manner of introduction will have to be revised to minimise these, otherwise alternatives be adequately prepared.

3.1.4 Product-Related Factors

Product cost, or appearance programme costs and opportunity costs may be factors that hinder the use of a new technology e.g. costs of irrigation set, difficulty associated with harvesting or processing an improved crop variety, shelf life or awareness of buyers of the new variety etc.
The focus here should be to ensure compatibility of the technology and to responsibly introduce one that will really be beneficial to users. As much as possible dependence on other people or technology may be minimised so that the technology is not hampered by extraneous factors beyond its design.

3.1.5   Service Quality- Related Factors

When individuals or communities decide where to go for services or technology, the factors that they will take into consideration will include:

- their perception of the quality of service provided
- the cost of services
- the attitudes of the personnel of the services
- the extent to which privacy is ensured and   anonymity (when required) guaranteed
- the availability of supplies and other needed services at the same place
- the distance to alternative services; and
- the experiences of their peers.

3.1.6   Method- Related Factors

When clients decide which of the variety of methods offered to choose, they will take a number of factors into consideration, including:

- the effectiveness of the method
- the side-effects (e.g. of chemical fertiliser on the soil)
- the safety of the method
- cultural and religious acceptability
- the mode of administration
- the ease and frequency of administration
- reversibility
- the need for close expert supervision; and
- the cost .

4.0   CONCLUSION

This unit has enabled you to understand that factors that affect successful delivery of a new technology to a community are multifaceted and can arise from any of the stakeholders involved in the process even the service providers. You have also been equipped by way of knowledge of these factors on how to be better technology transfer agents.

5.0   SUMMARY

In this unit, you have learnt that:

Í

- lack of adequate knowledge among providers, programme managers and policy-makers is an obstacle to the introduction of new technology in agricultural development programmes
- product cost or appearance, programme costs and opportunity costs may be factors that hinder the use of a new technology
- when individuals or communities decide where to go for services or technology, the factors that they will take into consideration will include the attitudes of the personnel of the services.

6.0   TUTOR-MARKED ASSIGNMENT

  i. 1. List the categories of factors that can affect introduction of new technology.
 ii. 2. Explain major service quality factors that an extension agent must pay careful attention to   when introducing a new technology.
iii. 3. Mention 5 important factors clients will consider when deciding on which of the variety of methods offered to choose in the application of technology.

7.0   REFERENCE/FURTHER READING

UNFPA   (N.D.)   "Introducing   a   New Technology."(www.un.org/popin/regonal/asiapac/fiji/train mat)

MODULE 4

Unit 1   Functions of Change Agents in Technology Transfer
Unit 2   Ethical Considerations in Introducing Technological Changes
Unit 3   Agricultural Engineers and the Public Extension System

UNIT 1   FUNCTIONS   OF   CHANGE   AGENTS   IN   TECHNOLOGY TRANSFER

CONTENTS

1.0   Introduction
2.0   Objectives
3.0   Main Content
        3.1   What is Technology Transfer?
        3.2   Functions of Extension Agents in Technology Transfer
        3.3   Some Basic Rules of Effective Technology Transfer
            3.4   Other Important Lessons
4.0   Conclusion
5.0   Summary
6.0   Tutor-Marked Assignment
7.0   References/Further Reading

1.0   INTRODUCTION

In the broadest sense, technology transfer is a process of communication that results in putting research findings or new information into practice. Research is implemented as a result of technology transfer activity, whether the process of technology transfer is formally engaged in or not. Implementation of research is more likely to occur, however, when technology transfer is practiced formally and purposefully. To be most successful, technology transfer must engage all those involved in the research and implementation process. Technology transfer should not only be a consideration upon the conclusion of research; instead, it is a process that most effectively is integrated throughout the entire research effort, resulting in greater benefit from the research results.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- define   the term technology transfer
- list the do's and don'ts of extension agent when planning and implementing a technology transfer process
- demonstrate adequate knowledge on how to successfully transfer a new technology to your clients.

3.0   MAIN CONTENT

3.1   What is Technology Transfer?

Technology transfer is a proactive form of advocacy for change through adoption of technology. Practitioners of technology transfer are variously referred to as change agents, communicators, teachers, trainers, technology marketers, and by many other terms. Whereas they are usually welcomed, the idea of change that they advocate is frequently resisted. Moreover, it is nearly always impossible to measure, by any commonly accepted method, whether the technology they profess has actually transferred.

There are many definitions of technology transfer. One of the crispest definitions was offered by Robert Krull (1990): "Technology transfer is a process by which existing technology is transferred or transformed to fulfill the user's needs."A more detailed definition was given by Hodgkins, (1989): "Technology transfer is the process by which research and other new technologies are transferred into useful processes, products, and programs. Another way of saying the same thing is: technology transfer is the process by which a better way of doing something is put into use as quickly as possible." An earlier technology transfer according to Schmitt *et al* (1985) suggests that technology transfer "refers to all the activities leading to the appropriate adoption of a new product or procedure by any group of users. 'New' is used in a special sense as it means *any* improvement over existing technologies or processes, *not necessarily a chronologically recent invention.*" The authors go on to say, "Technology transfer is not simply information dissemination; that is, it is not simply sending out information—whatever the form—and then passively awaiting its use. Technology transfer is a more active term. It implies interaction between technology sponsors and users and results in actual innovation."

A recent study of technology transfer processes in the United States and Germany led to the following comprehensive definition, which adopts a private-sector point of view: Technology transfer (is defined) as the movement of technological and technology related organisational know-how among partners (individuals, institutions, and enterprises) in order to enhance at least one partner's knowledge and expertise and strengthen each partner's competitive position (Abramson *et al* 1997). Technology transfer occurs at all stages of the technology innovation process, from initial idea to final product. . . . These processes integrate multiple functions, including organised research and development, design, production engineering, manufacturing, marketing, and other value-adding activities in a complex web containing multiple feedback loops (Kline *et al* 1986). Like the innovation process, technology transfer is usually interactive, involving multiple transfer steps. Many have said that technology transfer is successful only if it results in a positive change. Teaching a new skill or method may not really qualify as technology transfer unless, and until, it results in change. The challenge, therefore, is to insist on having successful technology transfer, and not simply an exchange of information.

3.2   Functions of Extension Agents in Technology Transfer

1.   Identification of user needs (via questionnaires, focus groups, market   research, and direct contact, to name a few methods).
 .   Survey community; identify potential constraints.
2.   Ensure that national and local legislation and regulations permit use of technology; obtain necessary approvals.
3.   Estimate potential demand.
4.   Arrange programme financing; develop budget.
5.   Identify community facilities.
6.   Establish essential policies:
   • client selection criteria
   • counseling and informed choice
   • agricultural service standards.
8.   Staff the programme:
   • staffing requirements - patterns, types, numbers
   • recruitment and selection
   • training
   • supervision.
9.   Arrange for equipment, supplies and services:
   • procurement of required equipment, instruments and supplies
   • storage and inventory control

- procedures for decontaminating, cleaning and disinfecting or sterilising instruments.

10.   Develop a community information and communication programme: Possible communication channels include the following:

- associations of agricultural professionals and the journals they produce
- the mass media, including radio, television, the cinema, newspapers and audio- and videotapes
- printed materials developed specifically for the technology and designed to be relevant to local conditions
- personal communication. Informal meetings at communities to set up a network of satisfied technology users
- traditional or folk media.

11.   Develop and print record forms, information materials and documents;

- client record form
- client brochures (e.g. fact-sheet).

12. Establish client-referral channels; develop links with other extension agents and community institutions and professionals.

13. Feedback (to the developers and manufacturers of the technology concerning problems identified, suggestions for improvement, etc.).

3.3   Some Basic Rules of Effective Technology Transfer

- Rule 1: Communication is everything.
- Rule 2: Technology transfer is not easy.
- Rule 3: If you build a better mousetrap, the world will not beat a path to your door.
- Rule 4: The most respected opinion is always that of your peers.
- Rule 5: An unwilling user can always find a way to make an idea fail.
- Rule 6: If it does not make your life a lot better, you will not want to do it.
- Rule 7: Employees will not try anything that will cause them to lose their jobs.
- Rule 8: Researchers prefer to bend problems to suit their methods.

- Rule 9: Users of research prefer to bend methods to suit their problems.
- Rule 10: Users always think that the researcher does not understand the problem; researchers always think that the user does not understand the method.
- Rule 11: A written report is never fully understood by anyone but its author.
- Rule 12: The wrong person always gets the report.
- Rule 13: A written report longer than 50 pages will never get read thoroughly.
- Rule 14: Most people in local agencies do not read anything.
- Rule 15: Showing and telling is more effective than just showing or just telling.

3.4   Other Important Lessons

Practitioners of technology transfer have found that its hardest lessons can be summarised as follows:

- people and organisations are naturally resistant to change
- personal contact—the human element—is the most important factor in the diffusion and adoption of innovation
- personal contact—through one-to-one technical assistance and special transfer agents—is expensive in the short run, but immeasurably cost-effective in the long run
- effective communication of new ideas and techniques is best done through multiple channels: people, newsletters, case study reports, professional association networks, and publications. No one way will be enough
- the experience and endorsement of peers are important elements in the widespread adoption of innovation and technology
- acceptance of new technology takes time and a lot of work, and it involves risk.

4.0   CONCLUSION

This unit has enabled you to understand the concepts of technological transfer and the various functions the extension agents are expected to play in the process. Your knowledge on the expected roles of extension workers in the process has also been reinforced with lessons from the experiences of practitioners of technological transfer around the globe.

5.0 SUMMARY

In this unit, you have learnt that:

- technology transfer is a proactive form of advocacy for change through adoption of technology

- technology transfer is not simply information dissemination; that is, it is not simply sending out information—whatever the form—and then passively awaiting its use. Technology transfer is a more active term. It implies interaction between technology sponsors and users and results in actual innovation

- teaching a new skill or method may not really qualify as technology transfer unless, and until, it results in change

- effective communication of new ideas and techniques is best done through multiple channels: people, newsletters, case study reports, professional association networks, and publications. No one way will be enough

- acceptance of new technology takes time and a lot of work, and it involves risk.

6.0 TUTOR-MARKED ASSIGNMENT

i. What is technology transfer?
ii. You have just been contacted as an extension agent to help get an agrarian community acquainted with and adopt an improved harvesting technology. Identify the various steps you will take to achieve this goal.

7.0 REFERENCES/FURTHER READING

Wallace, C. E. *et al*. (1998). *Transportation Research Circular 488: Transportation Technology Transfer: A Primer on the State of the Practice*. TRB.

National Research Council, Washington, D.C.

OECD (1990). Seminar on Technology Transfer and Adaptability in Industrialised Nations.

Summary Report. University of Florida Transportation Research Center.

Hodgkins, E. A. (1989).*NCHRP Synthesis of Highway Practice 150: Technology Transfer in*

Selected Highway Agencies. TRB, National Research Council, Washington, D.C.

UNIT 2   ETHICAL CONSIDERATIONS INTRODUCING TECHNOLOGICAL CHANGES

CONTENTS

1.0   INTRODUCTION

Embracing coherent ethical guidelines is essential for building inclusive knowledge societies and raising awareness about the ethical aspects and principles is central for upholding the fundamental values of freedom, equality, solidarity, tolerance and shared responsibility. Thus, Agricultural Extension experts must encourage the definition and adoption of best practices and voluntary, professional guidelines addressing ethical issues for media professionals, information producers, and service providers and users with due respect to freedom of expression. The speed of technological evolution leaves little time to decision-makers, legislators and other major stakeholders to anticipate and absorb changes before being challenged to adapt to the next wave of transformation. Lacking the time for lengthy reflection, the international community is often faced with immediate policy choices that carry serious moral and ethical consequences: Increase public infrastructure or permit preferential use by investors? Allow the market to oblige people to participate in digital systems or subsidise more traditional lifestyles? Let technology develop as it will or attempt to program machines to safeguard human rights? Lessons in this unit aim at providing an outlook to the ethical considerations of introducing information technologies.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- specify the do's and don'ts of extension agents when planning and implementing a technology transfer process
- demonstrate adequate knowledge on how to successfully transfer a new technology to your clients.

3.0   MAIN CONTENT

3.1   Ethics of Technology Transfer

Increasingly, providers of services for people with relatively static or diminishing resources and the marginalised are turning to assistive technology as a potential solution to the problem of the increased demand for services. While there are numerous potential benefits of assistive technology, both for service providers and service users, there are also a number of ethical issues. The aim of this lesson is to raise these issues and to emphasise the need for all stakeholders involved in the generation and transfer of technology to pay careful attention to them.

Beauchamp and Childress described four major principles which apply to health ethics:

1.   Autonomy,
2.   Beneficence
3.   Non-maleficence and
4.   Justice.

Autonomy is the notion of deliberated self-rule, or the ability of the individual to make choices; beneficence is the principle of working for the benefit of the individual; non-maleficence is the principle of doing no harm, and justice relates to a moral obligation to act on a fair adjudication between conflicting claims. These principles provide a framework which has been used by a number of authors to discuss the ethical issues associated with the use of technologies with various categories of people. The framework is equally useful for consideration of the ethical issues around transfer of agricultural technology.

3.1.1   Autonomy

Autonomy relates to self governance or personal control. One of the main aims of implementing technology transfer is the promotion of increased independence. For example, independence (and the increased opportunities for choice making which go hand in hand with it) can be one consequence of the use of smart home technology if the presence of staff is reduced. One of the most challenging ethical issues in the case of intended beneficiaries of technology is that of consent.   This relates directly to the moral principle of respect for autonomy which, according to Beauchamp and Childress has two   aspects: (i) non-subjection of autonomous actions to controlling   constraints by others, and (ii) respectful treatment in disclosing information, probing for and ensuring understanding and voluntariness, and fostering autonomous decision-making.

Consent in the case of vulnerable groups—such as children, women, — has been the subject of much debate. As much information as is reasonably needed to make a decision should be made available in an accessible format; that consent should be voluntary and not under any form of duress or undue influence from professionals, family or friends; and that consent   may   be written, oral or non-verbal and in the event of non-written consent it should be given in the presence of a witness. The practical implications of the principle of autonomy more generally, which are relevant to the application of technology of any kind; include the areas of effective provision of information, awareness of the issues of response bias and potential for unintentional coercion.

Information

As in the case of a new technology which is likely to be something which the potential recipient will not have experienced previously and, therefore, will quite possibly find difficult to imagine or understand. It should go without saying that explanations of the technology should be clear and simple. Pictures and photographs might help to maintain a person's attention to a topic that is not necessarily inherently interesting. However, there is nothing more than anecdotal evidence that such devices actually improve comprehension. Video presentations showing the potential technology in use with other people might be more helpful in giving the person information on which to base a consent decision. As technology, particularly smart home/farm technology, is likely to be novel to farmers, a useful first step might be for the provider organisation to seek consent for the person to try out the technology, either in their own home or farm, or in a demonstration area, depending

on the particular device. Seeking consent should not be a one-off activity. It should be regularly reviewed and people should be able to opt out at any point. Allowing try-outs and opt-outsis likely to be inconvenient at an organisational level and is certainly unlikely to be the cheapest option. This is a genuine   test of the organisation's ethical credentials and commitment to the consent process.

Response bias

There is a wealth of research evidence that rural farmers who are often the targets of agricultural technology have great difficulty responding to questions concerning abstract matters and are more prone than the general population to response bias . One example of response bias is "acquiescence" which is the tendency to respond positively, regardless of the question being asked. Another example is "recency" which is the tendency to select the last of two possible response options. For example, if asked whether they want manure or fertiliser a person might say "fertiliser". However, if the question was phrased "do you want fertiliser of manure" they might say "manure". High levels of acquiescence amongst illiterate farmers are frequently reported. People with low level of literacy may say yes to many yes-no questions in order to beagreeable and may say no to questions that mention socially undesirable behaviours to deny any association with these taboos. Therefore, the answers provided by people should not necessarily be taken at face value. Just because someone says they have understood what has been said might not be enough. It might be better to ask some simple questions relating to what has been described so that it can be established if the person genuinely understands.

Coercion

Most extension workers want the best for the farmers they serve and would be outraged at the idea of forcing farmers to do anything against their will. However, coercion can be quite subtle and unintentional. For example, where there is a new and exciting technology with potential for enhancing quality of life of farm animals. It is easy for policy makers, service providers and front-line extension workers to become enthused by, or even evangelical about the prospects of what might be achievable. However, if this enthusiasm comesacross too strongly during the process of gaining consent, there is a distinct possibility that the farmers might feel pressurised to consent. Again, there is research evidence which suggests that the reasons why people acquiesce include a wish to give socially desirable responses especially if the person   asking the questions is perceived as being of higher status than the respondent. Conversely, farmers might be coerced into saying no to a new

technology when it may be in their best interests to agree to its use. For example, farm labourers may be fearful of the introduction of new technology and how it will influence their work, and there may be a temptation to pass on perceived fears to service users.

3.1.2 Beneficence

Beneficence is about doing our best for those who we support or serve. Improved technology has the potential to benefit people in a number of ways. Simply introducing into a farm house a computer with internet access and supporting residents to use it can generate an array of positive outcomes. In addition to access to a world of information, computers can provide entertainment (e.g., music, film, games), education, a combination of thesetwo ("edutainment"), and they can facilitate a measure of social contact (e.g., through interaction via email, and use of blogs and chat rooms). Specially developed software designed for PCs or handheld PDAs can be used to teach home-based or work-based skills. For example, a PDA can provide verbal and iconic prompts for each of the tasks involved in processing a produce. Increased independence and autonomy can arise from such skill acquisition. Also, by decreasing the need for prompts or corrections by staff,   self-managed prompting systems (e.g., prompts to alert residents to overly loud music) can reduce inter-personal conflict which might arise between staff and tenants.

The various sensors that are combined to create the smart farm house may also help to remove dependence on "on-site" support and thereby increase autonomy and independence. Such technology   can increase comfort (e.g., environmental control such as automated temperature control and remotely controlled windows and curtains) and reduce risk (eg, door entry systems, "chair occupancy" and "wandering client" sensors, and smoke and flood detectors). The   list of potential applications of modern technology covers most aspects of life and is constantly expanding. When analysing the appropriateness of introducing an improved technology in any given situation from an ethical perspective it is important that the potential benefits which the farmers might gain are considered alongside any harm which might be caused.

3.1.3 Non-maleficence

A fundamental bioethical principle is that of not causing harm as a result of an intervention. There are a number of areas where a new technology has the potential to cause harm, some more serious than others. They are considered below.

Stigma

A simple definition of stigma is that it is a sign of social unacceptability because of "the shame or disgrace attached tosomething regarded as socially unacceptable".   Stigma arises as a product of four social processes. First, people distinguish and label human differences. Secondly, dominant cultural beliefs link labeled people to undesirable characteristics and negative stereotypes. In the third social process, labeled people are placed in distinct categories to   accomplish some degree of separation of "us" from "them". In the fourth, those labeled experience status loss, and discrimination that lead to unequal outcomes. This in turn can lead to anxiety, depression, a distorted self-image and low self esteem. It has long been recognised that adopters of an innovation can be stigmatised   and to counter this many social workers provide their clients   with "values-based" training which,   typically, emphasises the importance of people with early adoption being afforded status and respect by engaging in activities, and behaving in ways which are perceived to be "socially valued" .

Risk

It might have been equally appropriate to raise the issue of "risk" under the heading of beneficence. Clearly, improved technology such as chemical fertilisers provide more rapid growth of crop plants which supplements   farmyard manure. However, consideration should be given to possible increased risks if such technology is used in place of manure.

Social contact

When improved technology is coupled with operational practices like telecare, the impact on the individual's level of social contact is also an important ethical issue. It is well documented that the marginalised groups often have very restricted social networks outside of   family members and groups. For many people, contact with staff is the main type of social interaction they have, and staff are often categorised by the marginalised as friends. For example, Robertson *et al* reported that the median size of social networks of a sample of 500 marginalised individuals in the community was five people (range 0–20). The median size was reduced to only two people when staffs were   excluded. Initiatives such as telecare can lead to reduced staff involvement with people, and any loss of this type of social contact is something which needs to be factored into ethical considerations. If increased social isolation is identified as a potential consequence of a technology in a given situation, considerationshould be given to compensatory

strategies, such as fostering relations with neighbours or exploring more leisure activities with social contact in mind.

3.1.4 Justice

Beauchamp and Childress called the fourth principle of bioethics in their framework- justice. Justice is partly about respecting the needs and opinions of the individual, ensuring their wellbeing and keeping them informed. These issues have been covered above. Justice is also about fairness and in this respect it extends beyond the individual.

4.0   CONCLUSION

Ethical solutions to problems are rarely straightforward. There is a need for experiences to be shared in the relatively early stages of the implementation of technology transfer so that effective guidance on the associated ethical issues can be provided to practitioners, service users and their representatives.

5.0   SUMMARY

In this unit, you have learnt that:

- embracing coherent ethical guidelines is essential for building inclusive knowledge societies and raising awareness about the ethical aspects and principles is central for upholding the fundamental values of freedom, equality, solidarity, tolerance and shared responsibility
- rural farmers who are often the targets of agricultural technology have great difficulty responding to questions concerning abstract matters and are more prone than the general population to response bias
- there are a number of areas where a new technology has the potential to benefit the users and also to cause harm.

6.0   TUTOR-MARKED ASSIGNMENT

i.   List the four major ethical issues associated with the use of technologies with various categories of people.

ii.   Briefly explain the following as it relates to ethics of introducing technological changes

(a)   Autonomy

(b)   Beneficence
(c)   Non-maleficence and
(d)   Justice.

7.0   REFERENCES/FURTHER READING

Mary, R. & Chris, C. (2007). *Ethical Implications of Emerging Technologies: A Survey*. *Geneva Net Dialogue* as Edited by the Information Society Division, Communication and Information Sector. Boyan Radoykov (Ed.). Paris: UNESCO.

Perry, J. *et al.* (2009). "Assistive Technology, Telecare and People with Intellectual Disabilities: Ethical Considerations". *Journal of Medical Ethics* ; 35:81-86.

UNIT 3   AGRICULTURAL ENGINEERS AND THE PUBLIC EXTENSION SYSTEM

CONTENTS

1.0   INTRODUCTION

Although agricultural engineering is a fairly new subject, its effect is being felt in Nigeria increasingly. In recent years it has contributed to agricultural production in the country both directly and indirectly. The number of modern machines used in agriculture is a fairly good index of the progress made in the past few years. And yet all this progress is insignificant as compared to that in India, USSR, USA, Japan, UK Canada, and Australia. This development has made one thing clear: the need for deeper collaboration between the Nigerian agricultural engineers and the extension workers for a more accelerated agricultural development.

2.0   OBJECTIVES

At the end of this unit, you should be able to:

- state the relevance of agricultural extension to achieving the goal of mechanising Nigerian agriculture
- demonstrate adequate knowledge of the role of extension agents including that of other stakeholders in mechanising Nigerian agriculture.

3.0 MAIN CONTENT

3.1 Agricultural Mechanisation in Nigeria

Agricultural engineering as defined by international institutions comprises of four main branches:

(i) Farm implements
(ii) Rural structures
(iii) Soil conservation, drainage, and irrigation and
(iv) Rural electricity.

Because of the peculiar local conditions of inadequate electricity on a large scale, and the immediate utility of implements, agricultural engineering in Nigeria is more of agricultural implements and machinery. But in fact agricultural engineering is a very vast subject and may be defined as the application of the knowledge, techniques and disciplines of various fields of engineering to the solution of problems arising in the field of agriculture and rural living with the objective of reducing manual labour, improving productivity and raising the standard of living of the farmer and increasing the overall earnings per worker.

The era of more intensive planning brought re-organisation on a wider scale. With the establishment of agricultural universities, several agricultural engineering colleges/faculties were established offering graduate and post graduate courses. The most important step has been the establishment of agro-industries corporations with the financial assistance of the Federal Ministry of Agriculture. The main objectives of establishing these corporations have been to take over the supply and service functions of the departments of agriculture and to expand them.

The other most important development has been in the field of industry which has a number of factories for manufacturing tractors, power tillers, and several oil engines and electrically driven pumping sets. These helped to quicken the pace of mechanisation of Nigerian agriculture. It is not merely the knowledge of agricultural engineering which is needed for increasing production, but also the knowledge of their availability, prices and upkeep. This brought to the fore the relevance of agricultural extension to achieving the farm mechanisation of Nigerian agriculture. Information can be obtained from:

1. at the village level: the village level worker or Extension Agents
2. at the block level: the Agricultural Extension Officer or the District Planning Officer

3.   at the district level: the District Agricultural Officer or the District Planning Officer
4.   at the state level: the State Agricultural Engineering Section and the Managing Director of the state agro-industries corporation
5.   at the Central level: the Director of Agricultural implements and Ministry of Agriculture and Irrigation.

3.2   Fast-tracking Agricultural Mechanisation: The India Experience and Lessons from Nigeria

3.2.1   Collaborative Approach

In India, the private sector as well as the government, through their agro-industries corporations assist in the field as it relates to the supply of agricultural machinery to farmers. To prevent the charging of exorbitant prices for tractors, the government has fixed the price of tractors with the assistance of the Bureau of Cost Accounting in the Ministry of Finance. This organisation has helped the farmers very much.

Agricultural aviation is now gaining ground in India. At present airplanes and helicopters are being used mainly for spraying pesticides with future plan to use them for sowing and spraying liquid fertilisers on crops. Agricultural electronics has also begun and remote-control tractors are being designed and tested in some countries. With the successful explosion of an atomic device, India may be able to generate more electricity in the future. The availability of adequate irrigation water as a result of the Ganga-Kauveri project and the availability of more electricity from atomic energy will make the progress of farm mechanisation in India faster. Thus the future seems to be bright.

3.2.2   Development of Agricultural Implements and Machinery

The beginning of mechanisation of Indian agriculture was made by the use of improved hand tools and improved bullock-drawn implements. Particular emphasis was laid on these items during the first five year plans and slowly more sophisticated implements were introduced. These included power-driven threshers, tractors and the combine harvesters. Quite a variety of implements is required for carrying out agricultural operations, starting from the opening of the land to harvesting, threshing, winnowing and storage. These operations include ploughing, harrowing, leveling, sowing, inter-cultivation, application of fertilisers and manures, harvesting, threshing and winnowing.

A variety of these implements were in use in the country in the last centuries. Before efforts were made to introduce foreign implements, a survey of implements used in India was taken. Consequently, under the Indian Council of Agricultural Research a country wide survey was carried out and its report was published. This brought many facts to light. The number of implements used by the Indian farmer is very large. Some of these implements are crude to look at but are very useful and the consensus of the agricultural engineers of India has been that it would be easier at least as a first step to improve upon the indigenous implements in order to increase their efficiency and thus give to the Indian farmers something which is within their means.

To achieve this objective effectively, the Indian Council of Agricultural Research has now established one research-cum testing and training centre in each state. Some of them have now been converted into regional centres or have been taken over by the state governments. The objective is to improve the indigenous agricultural implements, to design new implements and to test them in the field up to the prototype level. After the implements have proved to be useful, the prototypes can be given to manufacturers in public or private sectors and the implements can be sold through them to the farmers.

3.2.3   Principles of Research

In India, the holdings are generally small, the average farmer is poor, and the drought cattle are also small and ill fed. Taking these into account certain principles have been laid down which are:

1.   That the implements and machinery for the Indian farmers should be simple in construction, so that they could be operated by the illiterate farmers, and should either be   manufactured or could be repaired by the village artisans or mechanics.
2.   The prices of the implements should be within reach of the ordinary farmer. In case of power-driven equipment the challenge of high cost can be overcome by giving the machinery on hire or hire-purchase system or on custom basis or on co-operative basis.
3.   The implements should be light so that they can be easily transported and suitable for the drought animals.
4.   That the implements should be scientifically tested on a fairly uniform basis throughout India.
5.   In designing the implements the local available materials are to be used. In the case of soil working and plant working parts durable materials such as carbon steel should be used.

To fulfill these requirements, the Indian Council of Agricultural Research has also designed procedures for testing and designing implements and proformas in which the test data are to be listed. Quite a large number of farmers are using the power machines like tractors, oil engines and pumps. Thus the trend towards mechanised farming is bound to increase.

Recently, new developments have taken place to bring about mechanisation of agriculture. Owing to the shortage of diesel oil and its increased price, the mechanical operation will have to be restricted to deep ploughing, land leveling, land clearing and other operations which cannot be carried out by bullock power. For short distances bullock carts are more effective than trucks; hence the necessity for improving them.

4.0   CONCLUSION

The need for deeper collaboration between Nigerian agricultural engineers and the Extension workers for a more accelerated agricultural development cannot be overemphasised. Experience of multi-stakeholder collaboration and research-based technology development to ensure compatibility with local knowledge and practice is very essential to achieve full mechanisation of Nigerian agriculture.

5.0   SUMMARY

In this unit, you have learnt that:

- agricultural engineering comprises of four main branches
- because of the peculiar local conditions of inadequate electricity on a large scale, and the immediate utility of implements, agricultural engineering in Nigeria is more of agricultural implements and machinery
- the establishment of agro-industries corporations and industry which has a number of factories for manufacturing tractors has helped to quicken the pace of mechanisation of Nigerian agriculture.

6.0   TUTOR-MARKED ASSIGNMENT

i.   Explain the following terms:
   (a)   Agricultural engineering
   (b)   Agricultural mechanisation
ii.   State 5 important principles of consideration in designing farm implements for agricultural mechanisation.

iii.   Mention possible sources of knowledge of the availability, prices and upkeep of farm machinery at the various levels of an agrarian society.

7.0   REFERENCE/FURTHER READING

"Agricultural   Extension   Education" (http://www.krishiworld.com/html/agri_extension_edu1.html)