COURSE GUIDE

AEA 305
INTRODUCTION TO AGRICUTURAL FINANCE

CREDIT UNITS: 2 UNITS

Course Team Dr. O. Bamiro (Course Developer/Writer) - Landmark University, Omu Aran
Dr. Esheya Samuel Esheya (Course Reviewer) – NOUN

NATIONAL OPEN UNIVERSITY OF NIGERIA

National Open University of Nigeria,
Headquarters,
University Village,
Plot 91, Cadastral Zone,
Nnamdi Azikiwe Expressway,
Jabi, Abuja.

Lagos Office
14/16 Ahmadu Bello Way
Victoria Island, Lagos

e-mail: centralinfo@nou.edu.ng
URL: www.nouedu.net

Printed in 2016

Reviewed in January 2022

ISBN: 976-059-078-7

CONTENTS **PAGE**

INTRODUCTION

AEA305 – Introduction to Agricultural Insurance is one the courses in the Department of Agricultural Economics and Extension. It is a two-credit course. The course consists of 21 units, in six modules which deal with insurance and management of risks in the agricultural sector. This course guide tells you briefly what the course is all about, and how you can work through these units. It suggests some general guidelines for the amount of time you are likely to spend studying each unit in order to complete it successfully. It also gives you some guidance on your tutor-marked assignment.

WHAT YOU WILL LEARN IN THIS COURSE

The main aim of this course is to introduce you to the nitty-gritty of insurance and risk management in the agricultural sector. By studying this course you will be able to understand the nature of insurance risks that you can come across in the agricultural sector; you will get to know of various mitigating factors too.

COURSE AIMS

The aim of the cause is to acquaint you with the basic principles of insurance risk management in agriculture. This will be achieved by:

- Meaning and scope of agricultural insurance.
- Nature of agriculture necessitating insurance -taking.
- Nigerian Agricultural Insurance Company: history, performance, scope, limitations, future prospects.
- exposing you to the features of agricultural production
- describing the nature of agricultural products that subject farming to innumerable risks and uncertainties
- describing the implications of the nature of agricultural products on transportation, and demand and supply of agricultural products
- differentiating between agricultural products and products from other sectors
- defining risk
- Principles and concepts of risk and uncertainty.
- explaining the nature of agricultural risks
- stating the risks in crop production and livestock industry
- distinguishing between risk and uncertainty
- identifying the sources of agricultural risks
- discussing the sources of risks and their implication on agricultural production
- explaining risks that are peculiar to agriculture
- identifying the sources of each type of risks

- differentiating between input and output risks
- explaining the risk attitudes of farmers
- stating the determinants of risk attitudes
- discussing the implications of each category of risk attitudes on adoption of innovation
- explaining management principles that can be used to mitigate specific agricultural risks
- stating the importance of information in risk mitigation
- discussing the roles of technology in risk mitigation
- defining risk assessment
- identifying the variables that should be quantified in risk measurement
- explaining layers of risk
- identifying the risk layers that require government intervention
- stating the rationale for government intervention in risk management
- discussing the government policies targeted at risk management
- identifying the role of information and ICTs in risk management
- highlighting specific ICT gadgets that are can be used for risk management in developing countries
- stating the external supports necessary for ICTs in risk management
- discussing how ICTs can be used to mitigate agricultural risks.

COURSE OBJECTIVES

In order to achieve the course aims, certain overall objectives have been set. In each unit specific objectives are set. These objectives are usually stated at the beginning of each unit. You should pay attention to the objectives of each unit before reading through the unit. You can always refer back to the unit's objectives to check your progress. You should also look at them after completing a unit. By so doing, you can be sure that you have achieved what the unit expects you to acquire. By meeting these objectives, the aims of the course as a whole would have been achieved. So, at the end of this course, you should be able to:

- meaning and scope of agricultural insurance
- NAIC: history, performance, scope, limitations, future prospects
- explain the features of agricultural production necessitating insurance taking
- describe the nature of agricultural products that subject farming to innumerable risks and uncertainties
- describe the implications of the nature of agricultural products on transportation, and demand and supply of agricultural products
- differentiate between agricultural products and products from other sectors

- define risk
- explain the nature of agricultural risks
- state the risks in crop production and livestock industry
- distinguish between risk and uncertainty
- identify the sources of agricultural risks
- discuss the sources of risks and their implication on agricultural production
- explain risks that are peculiar to agriculture
- identify the sources of each type of risks
- differentiate between input and output risks
- explain the risk attitudes of farmers
- state the determinants of risk attitudes

WORKING THROUGH THIS COURSE

To complete this course you are required to read the study units carefully and read other recommended materials. You will be required to answer some questions based on what you have read in the Content to reaffirm the key points. At the end of each unit, there are some Tutor- Marked Assignments (TMA) which you are expected to submit for Marking. The TMA forms part of your continuous assignments. At the end of the course is a final examination. The course should take you a number of weeks to complete. The component of the course is given to you to know what to do and how you should allocate your time to each unit, in order to complete the course successfully- on time.

COURSE MATERIALS

The main components of the course are:

1 Course guide
2 Study units
3 Textbooks
4 Assignment file
5 Presentation schedule

STUDY UNITS

Module 1 Nature of Agricultural Production

Unit 1 Meaning of Agriculture, Characteristics of Agricultural Production
Unit 2 Nature of Agricultural Products
Unit 3 Problems of Agricultural Products Necessitating Insurance-Taking

TEXTBOOKS AND REFERENCES

At the end of every unit, you will find a list of books and other such materials that will enable you have a firm grasp of the course. The books required to aid your understanding of this course are by no means exhaustive here. You are, therefore, expected to consult as many materials as possible. This will enable you to deepen your understanding of the course.

ASSIGNMENT FILE

The file contains the details of all the assignments you must do and submit to your tutor for marking. The mark you obtain from these assignments will form part of the final mark you will obtain in this course.

ASSESSMENT

The course has two types of exercises or questions you are expected to tackle. The first is the Self-Assessment Exercises (SAEs) which you are expected to solve, but not to be submitted, at the end of the study. The second is the Tutor-Marked Assignment (TMAs) which you must solve and submit in an assignment file, in partial fulfillment of the requirements for the successful completion of the course. The TMA accounts for 30% of your total score for the course. Every unit has a Tutor – Marked Assignment, which is a compulsory question that must be answered and submitted at the end of the course. You will minimise your chance of doing well in the course if you fail to submit answers to all the Tutor-Marked Assignments, as required.

TUTOR-MARKED ASSIGNMENT (TMA)

There are tutor-Marked assignments and self-assessment exercises in each unit. You will have to do the TMA as a revision of each unit. This will help you to have broad view and better understanding of the subject. Your tutor/facilitator will inform you about the particular TMA you are to submit for marking and recording. Make sure your assignment reaches your tutor before the deadline given in the presentation schedule and assignment file. If, for any reason, you cannot complete your work on schedule, 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 there are exceptional circumstances. You will be able to complete your assignment questions from the contents of this course material and other recommended materials. However, it is desirable to search other References/Further reading, which will give you a broader view point and a deeper understanding of the subject.

FINAL EXAMINATION AND GRADING

The final examination for the course will be for a number of hours. The total Mark for the final examination is 70 percent. The examination will consist of questions, which reflect the tutor-Mark assignments that you might have previously encountered and other questions within the areas covered by the course. You are to use the time between finishing the last unit and sitting for the examination to revise the entire course. You may find it useful to review your tutor-marked assignment before the examination. The final examination covers information from all parts of the course.

PRESENTATION SCHEDULE

The presentation schedule gives you the important dates for the completion of your tutor-marked assignments and when you will attend tutorials. Remember that you are required to submit your assignments according to the schedule.

COURSE MARKING SCHEME

The table below shows how actual course marking scheme is broken down.

Table 1: Course Marking Scheme

Assessments	**Marks**
Assignments	Here, the best will be selected; which will make up 30% of total course mark.
Final examination	70% of overall course mark
Total	100% of course marks

FACILITATORS/TUTORS AND TUTORIALS

A number of online facilitation or tutorial hours are provided for in this course to enable the students and their tutors to meet and examine the contents of the course at intervals. You will be informed of the dates, time, and venue for these tutorials, along with the name and particulars of your tutor as soon as one is assigned to your group. Your tutor will grade and comment on your assignments, monitor your progress and provide answers to your questions during tutorials. You must submit your assignments in good time to enable your tutor to read them well and to make appropriate comments. Do not play with your tutorials or hesitate to consult your tutor when the need arises. Tutorials afford you opportunity to meet and discuss with your tutor face to face and they help

you to get immediate answers for troubling questions. Apart from tutorials, you may consult your tutor when:

- you do not understand any part of the study units
- you have difficulty understanding self-assessment exercises or tutor-marked assignment
- you have problems with the tutor's comments on your assignments or their grading. To gain maximally from the tutorials, you ought to prepare list of questions before attending them and you must endeavour to participate actively in discussions during tutorials.

SUMMARY

This course guide is designed to make studying the course a rewarding experience. However, what you get depends on how much time you dedicate to studying the various course units.

Best wishes!

MAIN COURSE

CONTENTS **PAGE**

Module 1 Nature of Agricultural Production

Unit 1 Meaning of Agriculture, Characteristics of Agricultural Production

Unit Structure

1.1 Introduction

Agriculture is bedeviled with a lot of risks and uncertainties due to the nature of agricultural production. Yet, greater percentages of Nigerians earn their livelihood from this sector, than from all other economic sectors put together. In Nigeria, households that depend on income from agriculture (either self-employed or as agricultural labour) account for about 70% of the population. Farming, unlike other enterprises is concerned with living things-plants and animals, which are subject to both biotic and abiotic factors that influence production and productivity. Some inherent characteristics of agricultural production and agricultural products subject farming to innumerable risks and uncertainties.

1.2 Learning Outcomes

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

- explain the features of agricultural production
- describe the nature of agricultural products that subject farming to innumerable risks and uncertainties

1.3 Main Content

1.3.1 Meaning and Characteristics of Agriculture

Agriculture describes the practice of growing crops or raising animals. Someone who works as a farmer is in the *agriculture* industry. The science, art, and business of cultivating soil, producing crops, and raising livestock; farming. The definition of agriculture is the science, art and business of farming and ranching. Commercial farms and ranches which provide vegetables and meat to the general public are examples of agriculture. It is the practice of cultivating plants and livestock. Agriculture can be defined as the production of food, feed, fiber and other products by the systematic growing and harvesting of plants and rearing of animals to sustain life. Agriculture deals with farming and/or raising livestock (*Chantrell, 2002*).

Agriculture was the key development in the rise of sedentary human civilization whereby farming of domesticated species created food surpluses that enabled people to live in cities. The history of agriculture began thousands of years ago. After gathering wild grains beginning at least 105,000 years ago, nascent farmers began to plant them around 11,500 years ago. Pigs, sheep, and cattle were domesticated over 10,000 years ago. Plants were independently cultivated in at least 11 regions of the world. Industrial agriculture based on large-scale monoculture in the twentieth century came to dominate agricultural output, though about 2 billion people still depended on subsistence agriculture (Anderson, 2020). Crops livestock are living things; hence, they are subject to both biotic and abiotic factors, which have made their production subject to risks.

1.3.2 Features of Agricultural Production and Risks

Biological process

Agricultural production is a biological process. The growing of crops and rearing of livestock are biological processes. Crops germinate, grow up and reproduce by natural processes. Chicken, sheep, goats, cattle and other livestock grow up and reproduce by natural processes. Although a lot of the inputs may be industrial products such as fertilizers and other agro-chemicals, feeds and mechanical implements and gadgets; the commodities themselves result from biological activities over which man has limited influence. The implications of this are in two folds; first, the weather condition may not be favourable thereby leading to reduced output. This is known as production (output risk).

Secondly, within the natural time limit of a production cycle, nothing can be done to hasten or lengthen the production of agricultural products.

Even if demand unexpectedly increases while production has not completed its cycle, supply cannot respond. This will subject the farming enterprise to input risk. On the other hand, many industrial production processes can be manipulated to meet demands as they come and fluctuations in prices can easily be moderated.

Seasonality

Closely related to the fact that agricultural production is biological is the fact that it is also seasonal. The production of many crops depends on seasons, especially the rainy season. Many crops are rain fed and may not be produced during the dry season. Although irrigation is done to remove this bottle-neck in a number of cases as in maize, rice and some vegetables, this is practicable under high level technology large scale agriculture. Most farmers still depend on rain water for their production especially as water sources for irrigation may be unavailable or may depend on rain. This weather condition- a major determinant in crop production, subjects crop production to climatic risk which comes under the umbrella of production risk.

Many other agricultural production processes depend on the seasons for full output. Some crops which are sensitive to photo-periodism perform well during certain periods of the year. Cowpeas, melon and groundnuts are known to be sensitive to the time of planting. Some livestock are known to reproduce in large numbers at certain periods of the year e.g. pigs and layer poultry respond negatively to the heat stress of the peak of dry season. The implication of this characteristic is that agricultural products come into the market in large quantities at certain periods (the glut period) and are scarce during the lean periods thus creating fluctuations in prices. Price variability subjects agricultural production to price risk.

Structure of the industry

Structure of agricultural industry also subjects farming enterprise to price risk. Production of agricultural commodities is in the hands of small scale farmers who are scattered about; small quantities are put to the market and their forces are beyond the control of the farmers. Farmers are subject to market price fluctuations, as well as poor price elasticity of demand and supply.

This is a result of the biological nature of agricultural production and seasonality. Supply of agricultural products does not respond well to changes in demand and price. Similarly, the price elasticity of demand is poor. The proportionate changes in either the supply or demand for agricultural commodities are always less than the proportionate changes in price. The implication is that farmers find it difficult to take advantage

of price changes in the market and prices of agricultural products can get out of control.

Uncertainty of agricultural production
Agriculture is often characterised by high variability of production outcomes or, production risk. Unlike most other entrepreneurs, agricultural producers are not able to predict with certainty the amount of output that the production process will yield due to external factors such as weather, pests, and diseases. Agricultural producers can also be hindered by adverse events during harvesting that may result in production losses.

Self-Assessment Exercise

1: Agricultural production is a biological process. Explain.
2. What is the place of uncertainty in agric. production?

1.4 Conclusion

Agricultural production, unlike other enterprises in other sectors of the economy, undergoes biological process which made it dependent on factors which are not under the control of farmers thereby subject farming to innumerable risks.

1.5 Summary

In this unit, you have learnt the meaning of agriculture, features of agricultural production vis-a-vis agricultural risks.

1.6 References/Further Reading/Web Sources

Adegeye, A. J. & Dittoh. (1985). *Essentials of Agricultural Economics*. Ibadan: Impact Publishers Nig. Ltd.

Adesimi, A.A. (1988). *Farm Management Analysis with Perspective through the Development Process.*

Anderson, F. (2020). Problems faced in agricultural production, accessed from abdn.ac.uk on 28th February 2022.

Chantrell, G. (2002). The Oxford Dictionary of Word Histories. Oxford University Press, 14.

1.7 Possible Answers to Self-Assessment Exercises

1: Agricultural production is a biological process. Explain.

The growing of crops and rearing of livestock are biological processes. Crops germinate, grow up and reproduce by natural processes. Chicken, sheep, goats, cattle and other livestock grow up and reproduce by natural processes. Although a lot of the inputs may be industrial products such as fertilizers and other agro-chemicals, feeds and mechanical implements and gadgets; the commodities themselves result from biological activities over which man has limited influence. The implications of this are in two folds; first, the weather condition may not be favourable thereby leading to reduced output. This is known as production (output risk).

2. Place of uncertainty in agricultural production:

Agriculture is often characterised by high variability of production outcomes or, production risk. Unlike most other entrepreneurs, agricultural producers are not able to predict with certainty the amount of output that the production process will yield due to external factors such as weather, pests, and diseases. Agricultural producers can also be hindered by adverse events during harvesting that may result in production losses.

Unit 2 Nature Of Agricultural Products

Unit Structure

2.1 Introduction

The agricultural products are of different nature than industrial products. So the features of products can be divided into three major types on the basis of production, marketing and consumption. Each of these features has bearing on the risks that are associated with agricultural production.

2.2 Learning Outcomes

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

- explain the nature of agricultural products
- describe the implications of the nature of agricultural products on transportation, and demand and supply of agricultural products
- differentiate between agricultural products and products from other sectors.

2.3 Main Content

2.3.1 Nature of Agricultural Products

Here, let us consider the following.

(a) Perishability

Agricultural products are highly perishable being highly susceptible to adverse weather conditions, such as excessive heat, dryness or wetness. They easily deteriorate under unfavourable conditions and loose value. They therefore have to be disposed off quickly either by consumption or sale. Farmers cannot easily keep them to take advantage of better prices later.

(b) Bulkiness

Agricultural products are very bulky, that is, they have much more volume or weight or size than their real value. The volume/value ratio is very high. For example yams, potatoes, rice, *gari* and even vegetables occupy a lot of space, though their monetary value may be small. Industrial products are usually less bulky. This has implication for storage and transportation and the final price of the product.

(c) Differentiation

Agricultural products are not homogeneous; rather, they are differentiated physically in size and shape, for example yams, potatoes, oranges and eggs. They may be differentiated in quality, e.g. palm oil and *gari* in which we have different grades. They may also be differentiated by customer affinity in which case a consumer sticks to only a retailer for his purchase of *gari* or rice, for instance.

(d) Substitution

Agricultural products have zero or negligible elasticity of substitution. Food products are agricultural products. There are only a few synthetic products that may be used as food in special circumstances. Items of foodstuffs may be substituted one for the other, e.g. cocoyam may be substituted for white yams in making pounded yam. Rice and maize are close substitutes in the making of pottage ("tuwo"), but they are not perfect substitutes. Agricultural products therefore have negligible elasticity of substitution.

(e) Raw materials

Agricultural products are raw materials for agro-allied industries. When industrial demand competes with domestic demand, prices can become raised especially in adverse production conditions. The nature of agricultural products and their production processes, as discussed above, make their marketing to be unique and different from the marketing of industrial products. Industrial products are not easily perishable, not as bulky as agricultural products and are not seasonal; they are more homogeneous than agricultural products and often have acceptable substitutes. Prices do not therefore fluctuate in industrial marketing as in agricultural marketing.

Self-Assessment Exercise

1: State the difference between perishability and bulkiness.
2. What are the features of industrial products.

2.4 Conclusion

In this unit, you have learnt about the nature of agricultural products and its implications on transportation and their demand and supply.

2.5 Summary

Agricultural products, unlike manufacturing products are primary products; hence, they command low prices unless they are processed. Some of them are bulky, thus transportation from the farm to the market is often a problem, a condition that compels farmers to sell their products at the farm gate, at a relatively low price, to middlemen.

2.6 References/Further Reading/Web Sources

Adegeye, A. J. & Dittoh. (1985). *Essentials of Agricultural Economics*. Ibadan: Impact Publishers Nig. Ltd.

Adesimi, A.A. (1988). *Farm Management Analysis with Perspective through the Development Process.*

2.7 Possible Answers to Self-Assessment Exercises

1: State the difference between perishability and bulkiness.

Perishability: *Agricultural products are highly perishable being highly susceptible to adverse weather conditions, such as excessive heat, dryness or wetness. They easily deteriorate under unfavourable conditions and loose value. They therefore have to be disposed off quickly either by consumption or sale. Farmers cannot easily keep them to take advantage of better prices later.*

Bulkiness: *Agricultural products are very bulky, that is, they have much more volume or weight or size than their real value. The volume/value ratio is very high. For example yams, potatoes, rice,* gari *and even vegetables occupy a lot of space, though their monetary value may be small. Industrial products are usually less bulky. This has implication for storage and transportation and the final price of the product.*

2. **Features of industrial products:**
Industrial products are not easily perishable, not as bulky as agricultural products and are not seasonal; they are more homogeneous than agricultural products and often have acceptable substitutes. Prices do not therefore fluctuate in industrial marketing as in agricultural marketing.

Unit 3 Problems of Agricultural Products Necessitating Insurance Taking

Unit Structure

3.1 Introduction

The agricultural products are of different nature than industrial products. So the features of products can be divided into three major types on the basis of production, marketing and consumption. Each of these features has problems associated with it that necessitates insurance taking.

3.2 Learning Outcomes

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

- Identify the problems associated with agricultural products
- describe the problems of agricultural products that necessitates insurance taking

3.3 Main Content

3.3.1 Problems of Agricultural Products Necessitating Insurance

The major agricultural products can be broadly grouped into foods, fibers, fuels and raw materials (such as rubber). Food classes include cereals (grains), vegetables, fruits, oils, meat, milk, eggs and fungi. Over one-third of the world's workers are employed in agriculture, second only to the service sector, although in recent decades, the global trend of a decreasing number of agricultural workers continues, especially in developing countries where smallholding is being overtaken by industrial agriculture and mechanization that brings an enormous crop yield increase. According to Muller (2015), these are as follows:

1. Seasonal production

Unlike consumer goods and industrial goods which are produced throughout the year, agricultural goods can be produced only during a specific period in a year. There are summer crops and winter crops. Certain crops need lot of water. There are others that require only minimum water. In view of all these differences, all the crops cannot be grown in all the months in a year.

2. Difficult to control production

In the case of consumer and industrial goods it is possible for the producer to exercise direct control over production. But in the case of agricultural goods nature plays a vital role in production. If the cultivator has sown the seeds and is awaiting rains, failure of rains will hamper production. Agricultural production is much dependent on the availability of abundant water. Availability of water depends on rainfall.

3. Difficult to control quality and quantity of output

The producers of consumer and industrial goods can control both quality and quantity of output. It is not that easy in the case of agricultural production. Even if the producer (the farmer) uses good quality seeds, fertilizers and manures, the quality and quantity of output are determined mainly by natural factors.

4. Long waiting period

Production of consumer and industrial goods takes place almost continuously on a daily basis. But in the case of agricultural goods, the gestation period is too long. Thus, continuous production cannot be thought of.

5. Loss of crops due to pests and animals

The crops need to be protected from pests and animals. Every year, farmers suffer heavy loss of revenue due to crop loss caused by the activities of pests, insects and animals. To protect their crops, farmers, therefore, use pesticides, insecticides and so on. They also use electrical fences to safeguard their crops from cows, elephants and other animals.

6. Loss of production due to litigation

Another peculiar problem in agricultural production is that there is always litigation between the farmers over the land territory and other such issues. As a result, they may have to spend lot of time, money and efforts to win legal battles. This affects the time available for production and thereby affects output.

7. Small-scale production

In India, the number of small and marginal farmers is larger than the number of big landlords. The small and marginal farmers hardly own a

few acres of land. The quantity of output they turn out is hardly sufficient for their family needs. In fact, most of these people produce for their families rather than for the market.

8. Use of primitive techniques of production

In developed countries, agriculture gets the same importance that the industry gets. But in India, although industrial development has reached a significant level, agriculture still remains a neglected sector.

The farmers follow the conventional methods of production which affect the yield. They do not have access to the latest machines and equipment because they cannot afford to have these.

9. Ignorance of the producers

Producers of consumer and industrial goods have greater awareness than the producers of agricultural goods. As a result, the former can adapt to any kind of situation and come out of the problem.

For example, the producers of consumer and industrial goods can modify or update their products in tune with the demand and market trend. But the farmers are conservatives. They cannot adapt themselves to changes. They prefer to grow the same crop they grow every year.

10. Lack of collective bargaining

Industrialists have their own associations through which they represent all their grievances to the Government and are able to find a solution to any problem. But in the case of agriculture, the farmers do not have any such prominent association. As a result, although they have grievances, they are not in a position to represent the same in a proper manner.

Self-Assessment Exercise

1: Write short notes on loss of crops due to pests and animals.
2. Classify the major agricultural products.

3.4 Conclusion

A vast majority of Nigeria's population is dependent on agriculture for its livelihood. Agriculture also provides employment opportunities to many, both directly and indirectly. The production and marketing of agricultural goods poses certain peculiar problems for the producers. This is mainly because the agricultural goods possess certain peculiar characteristics which necessitates insurance taking.

3.5 Summary

These characteristics make it inevitable for farmers to undertake insurance cover if they must remain in business in the event of any unforeseen circumstances.

3.6 References/Further Readings/Web Sources

Adegeye, A. J. & Dittoh. (1985). *Essentials of Agricultural Economics*. Ibadan: Impact Publishers Nig. Ltd.

Adesimi, A.A. (1988). *Farm Management Analysis with Perspective through the Development Process.*

Mueller, U. G.(2015). The Evolution of Agriculture in Insects". Annual Review of Ecology, Evolution, and Systematics, 36, 563–595.

3.7 Possible Answers to Self-Assessment Exercises

1: The crops need to be protected from pests and animals. Every year, farmers suffer heavy loss of revenue due to crop loss caused by the activities of pests, insects and animals. To protect their crops, farmers, therefore, use pesticides, insecticides and so on. They also use electrical fences to safeguard their crops from cows, elephants and other animals.

2. The major agricultural products can be broadly grouped into foods, fibers, fuels and raw materials (such as rubber). Food classes include cereals (grains), vegetables, fruits, oils, meat, milk, eggs and fungi

Module 2 Meaning, Sources and Types of Risk

Unit 1 Meaning and Nature of Agricultural Risk

Unit Structure

1.1 Introduction

Risk is the possibility of adversity or loss, and refers to "uncertainty that matters." Consequently, risk management involves choosing among alternatives to reduce the effects of risk. It typically requires the evaluation of tradeoffs between changes in risk, expected returns, entrepreneurial freedom, and other variables. Understanding risk is a starting point to help producers make good management choices in situations where adversity and loss are possibilities.

1.2 Learning Outcomes

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

- define risk
- classify risk
- explain the nature of agricultural risks
- state the risks in crop production and livestock industry

- distinguish between risk and uncertainty.

1.3 Main Content

1.3.1 Meaning of Risk

There are many definitions of the term risk which are examined herein so that you can appreciate the nature of risk. An array of definitions is reviewed below towards establishing a framework for the discussion of risk. According to Bodie and Merton (1998), risk can be defined as uncertainty that affects an individual's welfare, and is often associated with adversity and loss. Risk can also be defined as uncertainty that "matters," and may involve the probability of losing money, possible harm to human health, repercussions that affect resources (irrigation, credit), and other types of events that affect a person's welfare. Uncertainty (a situation in which a person does not know for sure what will happen) is necessary for risk to occur, but uncertainty need not lead to a risky situation.

Risk is a variability or outcome that are measurable in an empirical or quantitative manner. The outcome for each particular item need not be predictable. It is also defined as a situation which exists when the future can be predicted with a specified degree of probability. According to Esheya (2011), when a risk situation prevails, one can state that the chances are, for instance 50-50 or 75-25 that an event will occur. Jhingan (2006) sees risk as a situation that the probability of obtaining some outcomes of an event is not precisely known. That is, known probabilities cannot be precisely assigned to these outcomes but their general level can be inferred. Ebong (2000) defined risk as a situation where all possible outcomes are known for a given activity and the probability associated with each outcome is also known.

Claire Schaffnit-Chatterjee (2010) defined risk as the potential deviation between expected and real outcomes. While this deviation may be positive or negative, a negative outcome has greater importance from a practical point of view and is usually the focus of decision-makers. Decision-making takes place in an environment of imperfect knowledge of the future - uncertainty - and is associated with risk which is normally defined as "uncertainty of outcomes" resulting in losses negatively affecting an individual's welfare. Risk is also defined more simply as a loss due to a damaging event. The advantage of this definition is that it can be materialised and measured easily (e.g. loss of agricultural production, loss of income).

Agricultural risk is associated with negative outcomes that stem from imperfectly predictable biological, climatic, and price variables. These

variables include natural adversities (for example, pests and diseases) and climatic factors not within the control of the farmers. They also include adverse changes in both input and output prices. Risk in agriculture is not only of concern to the individual farmer. It is also of importance to society as a whole, as risk-averse behaviour of farmers can lead to an allocation of farm resources which is not efficient, resulting in a sub-optimal overall allocation of resources and consequently lower overall welfare. For example, risk- averse farmers may not adopt a new productivity-enhancing technology because of potential risks associated with it, which results in a lower increase in output than possible.

Exposure to risk prevents farmers from easily planning ahead and making investments. In turn, risk inhibits external parties' willingness to invest in agriculture because of the uncertainty about the expected returns. Improved management of agricultural risk has significant potential to increase productivity enhancing investments in agriculture (World Bank, 2005).

1.3.2 Examples of Risks in Agriculture

Here, let us consider the following.

Maize marketing example
A maize farmer at harvest of his crop is faced with two options with respect to the sales of his harvest. He has to decide whether to sell the maize now at the current price or store them for sale in future, with the aim of selling the maize at higher price. The first option ensures return to his harvest but if he chooses the second option, he will incur storage cost vis-a-vis losses due to spoilage.

In addition, he is uncertain of the future price, which may fall, or rise. If the price rises, he will make profit, however the gain is a function of the difference between the current price and the future price. If on the other hand there is increase in supply of maize in the future, and thus a fall in price and a significant loss from a decision to store rather than to sell. This risk is hinged on the fact that the famer has no knowledge of what the future price will be at the time of decision making.

Disease outbreak example
A poultry farmer may decide to vaccinate or not to vaccinate his broilers. There is the probability that there will be no outbreak of disease and the farmers would have minimised his costs and thus maximise his profit; however, an outbreak of disease may results in wiping out the whole flock and great will be the losses of the farmer. Sometimes after observing all the necessary vaccinations, the risk of losses due to outbreak of disease might, not be ruled out.

These examples underscore the importance of risk in agriculture. Indeed risks and uncertainties are integral part of all walks of life. For instance, marital decision as per who a man or a lady marries is characterised by risks and uncertainties because you do not know what that man or lady will turn out to be in the future. Yet you are not to be afraid of risk in life, farm business and any other business enterprise rather, your concern should be how to manage the risk as an individual or organisation. You should also note that profit is a reward of risk bearing.

All things being equal, the higher the risk associated with an investment, the greater will be the expected income or profit.

1.3.3 Classification of Risk

Risk situation may be classified as a priori or statistical.
A priori probability prevails when sufficient information is known in advance about the general possibilities that the probability of a particular event occurring can be specified. If a fair coin is tossed once without bias, it must come up either 'head or tail'. Thus, the result of this experiment is predictable. The a prioiri probability of outcome can be established when the characteristics of the eventuality are known before hand. Thus, we can predict with certainty that with continuous role of a perfect dice, a 4 is a possible outcome out of several trials. It follows that one who entertains a game of chance is not faced with uncertainty but risks. Although the outcome of a single game cannot be predicted without error, the outcome over a large number of trials is certain.

In statistical risk, the probability of a future event can be stated on the basis of observed results of many observations. Here probabilities are assigned to future events based on recorded experiences. As to what has happened under similar circumstance. An example is the increase in pests and diseases of crops and livestock with the occurrence of late rainfall. The statistical probability of outcome can be established when: the sample of cases or observations is large enough; the observations are repeated in the population; and the observations are independent or randomly distributed in the manner of a stochastic variable. Insurance companies can predict the statistical probability of deaths, fire losses and similar outcomes with a degree of certainty, only when the number of cases or observations is sufficiently large and randomly distributed (Esheya, 2011).

1.3.4 Nature of Agricultural Risk

Risk is an unavoidable element in the business of agriculture. Production can vary widely from year to year due to unforeseen weather and market

conditions, causing wide swings in commodity prices; but risk, while inevitable, is often manageable.

Farmers make decisions in a risky, ever changing environment. The consequences of their decisions are generally not known when the decisions are made, and outcomes may be better or worse than expected. Variability of prices and yields are major sources of risk in agriculture. Changes in technology, legal and social concerns, and the human factor itself also contribute to the risky environment for farmers. Risky situations of concern are typically those in which- (i) there is a high possibility of adverse consequences and/or (ii) the adverse consequences, should they occur, would cause significant disruptions. Farmers and other business people, generally, do not get into risky situations unless there is a probability of making money. Higher profits are typically associated with higher risks. It is to their advantage that these risky but potentially profitable situations be managed as carefully as possible.

The following deductions underline the nature of agricultural risk:

- Agricultural risk varies in its possible occurrence and outcomes or consequences;
- The occurrence of agricultural risk and its outcomes depend on chance;
- Risk is characterised by uncertainty with respect to its occurrence and magnitude of loss;
- Risk refers to uncertainty because it is inherently linked to uncertainty or chance of a loss;
- Risk has been described as the possibility that loss will be greater than normal, expected, or usual.

Hence, the nature of risk is the premise upon which the rationale for risk mitigation, or management is based due to its unpredictable occurrence in most cases and the magnitude of the loss that do accompany it when it rears its ugly head. It is therefore imperative to understand the nature of agricultural risk so that farmers or farm managers and agribusiness enterprise can prepare and institute essential measures for mitigating, managing it or coping with it, or even precluding it from occurring.

Self-Assessment Exercise

1: State the nature of agricultural risk.

2. What is a priori probability?

1.3.5 Decision Environments

The environments under which decisions may be made can be classified based on availability of complete and accurate information, and how perfectly the decision maker may predict the state of the nature and the result of his decision. These categories are as follows.

Certainty: this is the state in which the decision maker knows in advance the specific outcome of each alternative. It implies that all relevant parameters such as costs, capacity, demand, and soon have known values.

Risk: this is the state of knowledge in which each of the alternative strategies leads to one of a set of specific outcomes, with each outcome occurring with a probability that is known to the decision maker.

Uncertainty: this is a state in which one or more alternatives strategies result in a set of possible specific outcomes whose probabilities are either not known or not meaningful.

1.3.6 Risks versus Uncertainty

Risk may be defined as the potential deviation between expected and real outcomes. While this deviation may be positive or negative, a negative outcome has greater importance from a practical point of view and is usually the focus of decision-makers. Risk is a situation where all possible outcomes are known for a given management decision and the probability associated with each possible outcome is also known. Risk refers to variability or outcomes which are measurable in an empirical or quantitative manner. Risk is insurable. Risk is uncertainty that affects an individual's welfare, and is often associated with adversity and loss. Risk is uncertainty that "matters," and may involve the probability of losing money, possible harm to human health, repercussions that affect resources (irrigation, credit), and other types of events that affect a person's welfare. Uncertainty is said to exist when either all the possible outcomes are not known, or the probability of the outcomes are not known or neither the outcomes nor the probabilities are known. It is a situation in which the probability of obtaining the outcome (s) of an event is not known. There is thus a plurality of possible outcomes to which no objective probability can be attached. Here there is no valid basis for assigning any kind of probability to future events. In contrast to pure risk, the probability of an outcome cannot be established in an empirical or quantitative sense for uncertainty. This is present when knowledge of the future is less than perfect in the sense that the parameters of the probability distribution (mean yield or price, variance, range or dispersion, skewness and kurtosis or shape of the distribution) cannot be determined. It refers to anticipation of the future and is peculiar to the mind each individual producer.

Uncertainty arises because the manager must formulate an image of the future in his mind but has no quantitative manner by which these predictions can be verified.

Uncertainty simply refers to future events where the parameters of the probability distribution cannot be determined empirically. It involves the making of decisions with less than perfect knowledge. Anticiptions of the future can be formed but there is no way that the farm manager can assemble enough homogeneous observations to predict the relevant probability distribution. Thus, he is forced to make decisions without adequate information but formulates some expectations of the most likely outcome. He arrives at a decision by making some estimates of the future and decides what outcome is most likely depending on the confidence he places in the outcome, then commits some resources to this plan of action. An example of uncertainty is the best time to dispose palm oil as a farm produce in search of the most profitable alternative. Since knowledge of the future is so imperfect, managers normally expect that a range of outcomes, rather than a single outcome, is possible (Esheya, 2011).

Uncertainty refers to risks that take place in an atmosphere of imperfect knowledge. In other words, the probability of occurrence cannot be determined. While the outcomes of risk are certain, the outcomes of uncertainty are uncertain. Risk can be managed but uncertainty cannot be managed. All possible outcomes are unknown; the probability of the outcomes is unknown. Uncertainty refers to future events where the parameters of probability distribution (mean yield or price, the variance, range or dispersion and the skew and kurtosis) cannot be determined empirically. Uncertainty is not insurable. Uncertainty (a situation in which a person does not know for sure what will happen) is necessary for risk to occur, but uncertainty need not lead to a risky situation.

1.4 Conclusion

In this unit, you have observed that risk is an unavoidable element in the business of agriculture and as a result, farmers make decisions in a risky, ever changing environment. The consequences of these decisions are unknown at the time they are made, because decisions are made several months or even years prior to the harvest season.

1.5 Summary

In this unit, you have learnt the following:

- meaning of risk
- classification of risk
- examples of agricultural risks

- nature of agricultural risk
- decision environments
- risk versus uncertainty.

1.6 References/Further Reading/Web Sources

Bodie, Zvi, & R. C. Merton. (1998). *Finance*. Upper Saddle River, NJ: Prentice Hall.

Ebong, V.O. (2000). Agribusiness management for a developing economy: the Nigerian perspective. Uyo: Dorand Publishers.

Esheya, S.E. (2011). Rudiments of agribusiness finance management for tertiary institutions. Abakaliki: Legro Press.

Jhingan, M.L. (2006). Macro-economic theory: Eleventh revised edition. Dehli: Vrinda Publications Limited.

Schaffnit-Chatterjee, C. (2010). *Risk Management in Agriculture: Towards Market Solutions in the EU*. Germany: Deutsche Bank Research Frankfurt am Main.

1.7 Possible Answers to Self-Assessment Exercises

1: State the nature of agricultural risk

- Agricultural risk varies in its possible occurrence and outcomes or consequences;
- The occurrence of agricultural risk and its outcomes depend on chance;
- Risk is characterised by uncertainty with respect to its occurrence and magnitude of loss;
- Risk refers to uncertainty because it is inherently linked to uncertainty or chance of a loss;
- Risk has been described as the possibility that loss will be greater than normal, expected, or usual.

2. **A priori probability** prevails when sufficient information is known in advance about the general possibilities that the probability of a particular event occurring can be specified. If a fair coin is tossed once without bias, it must come up either ‘head or tail’. Thus, the result of this experiment is predictable. The a prioiri probability of outcome can be established when the characteristics of the eventuality are known before hand. Thus, we can predict with certainty that with continuous role of a perfect dice, a 4 is a possible outcome out of several trials. It follows that one who

entertains a game of chance is not faced with uncertainty but risks. Although the outcome of a single game cannot be predicted without error, the outcome over a large number of trials is certain.

Unit 2 Sources of Risks in Agriculture

Unit Structure

2.1 Introduction

Agricultural risks stems from different sources, which can be internal or external; human beings, farmers' families or animals; natural occurrences, outbreak of pests and diseases and the actions or inaction of government and neighbouring farmers.

2.2 Learning Outcomes

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

- identify the sources of agricultural risks
- discuss the sources of risks and their implication on agricultural production.

2.3 Main Content

2.3.1 Sources of Risks

The following are the major sources of risks that you will learn about, here:

- Natural hazards
- Market fluctuations (of output prices)
- Social uncertainty (due to differences over control of resources) and
- State actions and wars.

2.3.1.1 Natural Hazards

It is well known that weather is an important production factor in agriculture. Unfortunately, this production factor can hardly be controlled. In fact, weather risks are a major source of uncertainty in agriculture and it seems that fluctuations of temperature and precipitation even increased in the last decade due to global climate changes. Hydro-meteorological risks such as droughts, cyclones and floods not only endanger human lives and property, but also have a devastating impact on food production and farmers' livelihood systems. Farm communities that do not have inbuilt buffering mechanisms, as in resource poor rain-fed regions, are disproportionately vulnerable to the severity of extreme climate events.

Climate change further compounds the problem, as it threatens to alter the frequency, severity and complexity of climate events, as also the vulnerability of high-risk regions in different parts of Nigeria. Drought or excess rain is responsible for bad harvests all over the world. Perhaps the most obvious impact of weather risk is on crop yields, but its relevance is not limited to crop production. The performance of livestock farms, the turnover of processors, the use of chemicals and fertilizers and the demand for many food products also depend on the weather. Hence, large parts of the agribusiness are affected by weather risks.

Outbreak of pests and diseases is another natural hazard that influences animal production, an outbreak disease may wipe out a whole poultry farms and thereby cause a great loss to farmers. Flood, drought, are also natural hazards that affect both crop and animal production.

2.3.1.2 Market Fluctuations

Fluctuations in market output vis-a-vis fluctuations in prices, is another source of risks in agricultural industry. The gestation periods of crops (period between planting and harvest) may be short or long. The price of a particular agricultural product may be very high at the planting season, but at the time of harvest, the price often falls due to large supply, but the high price of the product would have propelled farmers to plant large hectare of the crop. However, the fall in price will lead to reduction in net farm income.

2.3.1.3 Social Uncertainty

This source of risk has to do with differences in control of resources. The resources in agricultural industry are land labour, capital and entrepreneur. Increase in earnings of these inputs or resources will attract

resources into other sector of the economy at the expense of agricultural production. This will have negative effect on output and farmers' income.

2.3.1.4 Social Actions and Wars

Wars and social actions have great risk in agricultural industry. Conflict is an ever-present risk and one of the most common causes of food insecurity. The displacement of people and the disruption of agricultural production and food distribution leave tens of millions of people at risk of hunger and famine. Conversely, food insecurity may lead to or exacerbate conflict. The experience of Nigerians during the civil war between 1967 and 1970 is a good example of effect of war on farm business.

2.3.1.5 Actions and Inactions of Neighbouring Farmer

Most people have family, business, and personal goals. Typically, farmers will have some goals that will compete with one another and others that complement one another. Apart from family goals and actions, the pursuit of neighbouring farmers can be a risk source to farmers. In developing countries, where small scale farming is prevalent, if a farmer is diligent and keeps his farm clean while the neighbouring farm is weedy or bushy, such a neighbouring farm will serve as a hideout for rodents and other animals that can wipe out the crops of the diligent farmers. In risk management, farmers need to be aware of these interrelationships among goals and business enterprises.

Self-Assessment Exercise

1: Describe natural hazards as a major source of risk.

2. What is social uncertainty?

2.4 Conclusion

In this unit, you have learnt that almost all the sources of agricultural risks are external in nature; hence farmers have no control over these risk agents. Nevertheless, it is still expected that farmers will plan and prepare for their mitigation.

2.5 Summary

In this unit, you have been exposed to the sources of risks. These include natural hazard, market fluctuations, social uncertainty, social actions and

wars, as well as actions and inactions of family members and neighbouring farmers.

2.6 References/Further Readings/Web Sources

Hardaker, J. B., Huirne, R. B. M. & Anderson, J. R. (1997). *Coping with Risk in Agriculture.* Wallingford: CAB International.

2.7 Possible Answers to Self-Assessment Exercises

1: Describe natural hazards as a major source of risk.

1. **Natural Hazards:** It is well known that weather is an important production factor in agriculture. Unfortunately, this production factor can hardly be controlled. In fact, weather risks are a major source of uncertainty in agriculture and it seems that fluctuations of temperature and precipitation even increased in the last decade due to global climate changes. Hydro-meteorological risks such as droughts, cyclones and floods not only endanger human lives and property, but also have a devastating impact on food production and farmers' livelihood systems. Farm communities that do not have inbuilt buffering mechanisms, as in resource poor rain-fed regions, are disproportionately vulnerable to the severity of extreme climate events.

Climate change further compounds the problem, as it threatens to alter the frequency, severity and complexity of climate events, as also the vulnerability of high-risk regions in different parts of Nigeria. Drought or excess rain is responsible for bad harvests all over the world. Perhaps the most obvious impact of weather risk is on crop yields, but its relevance is not limited to crop production. The performance of livestock farms, the turnover of processors, the use of chemicals and fertilizers and the demand for many food products also depend on the weather. Hence, large parts of the agribusiness are affected by weather risks.

Outbreak of pests and diseases is another natural hazard that influences animal production, an outbreak disease may wipe out a whole poultry farms and thereby cause a great loss to farmers. Flood, drought, are also natural hazards that affect both crop and animal production.

2. Social Uncertainty

This source of risk has to do with differences in control of resources. The resources in agricultural industry are land labour, capital and entrepreneur. Increase in earnings of these inputs or resources will attract resources into other sector of the economy at the expense of agricultural production. This will have negative effect on output and farmers' income.

Unit 3 Categories of Risks in Agriculture

Unit Structure

3.1 Introduction

Farmers make decisions in a risky, ever-changing environment. The consequences of their decisions are generally not known when the decisions are made, and outcomes may be better or worse than expected. Variability of prices and yields are major sources of risk in agriculture. Changes in technology, legal and social concerns, and the human factor itself also contribute to the risky environment for farmers. Risky situations of concern are typically those in which- (i) there is a high possibility of adverse consequences and/or(ii) the adverse consequences, should they occur, would cause significant disruptions. Some risks are unique to agriculture, such as the risk of bad weather significantly reducing yields within a given year. Other risks, such as the price or institutional risks, while common to all businesses, reflect an added economic cost to the producer.

3.2 Learning Outcomes

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

- explain risks that are peculiar to agriculture
- identify the sources of each type of risks • differentiate between input and output risks.

3.3 Main Content

3.3.1 Types of Risks in Agricultural Production

Here, let us consider the following.

a. Production or yield risk

Any production related activity or event that is uncertain is a production risk. Agricultural production implies an expected outcome or yield. Variability in outcomes from those expected creates risks to your ability to achieve financial goals. Production or yield risk occurs because agriculture is affected by many uncontrollable events that are often related to weather, including excessive or insufficient rainfall, extreme temperatures, hail, insects, and diseases. Any production related activity or event that is uncertain is a production risk. Agricultural production implies an expected outcome or yield. Variability in outcomes from those expected creates risks to your ability to achieve financial goals.

Technology plays a key role in production risk in farming. The rapid introduction of new crop varieties and production techniques often offers the potential for improved efficiency, but may at times yield poor results, particularly in the short term. In contrast, the threat of obsolescence exists with certain practices (for example, using machinery for which parts are no longer available), which creates another, and different, kind of risk. For decades, agricultural risk has been synonymous with production risk. Reducing variability in expected yields has been a major focus of farm managers.

Over time, improvements in technology and production practices have helped decrease agronomic risks and increase yields. For example, genetic engineering has produced new seed varieties that are disease and drought resistant, commercial petroleum-based fertilizers were manufactured increasing yields, effective herbicides and insecticides were developed controlling weeds and bugs, and a whole host of improved production and management practices have been disseminated. The same underlying changes that are driving the increase in economic risks are also changing the nature of production risks.

Not only is yield variability still a formidable production risk, but also the industrialisation of agriculture is impacting the entire agricultural production sector. Changes that initially started in the livestock sector are now starting to revolutionise the crop industry. These structural shifts mean that farmers are vulnerable not only to the vagaries of weather and Mother Nature, but are vulnerable to economic forces that exacerbate traditional production risks.

Production risk is likely to grow, due to climate change and globalisation. Indeed, we expect a higher incidence of extreme weather events. Globalisation is also likely to drive an increased frequency of pest or disease outbreaks. Some consider that cross compliance measures with respect to agro-chemicals may also increase yield risk: e.g the Nitrate directive, or the Water directive requiring less spraying in the vicinity of water. It can also be argued that these measures will give incentives to use agro-chemicals more judiciously or to find alternatives (e.g. crop rotation), thus potentially reducing yield risk.

"Yield" risk is smaller in the livestock sector for most producers, as weather has a smaller influence. The risks mainly stem from disease, mechanical failure in confinement operations and variability in weight gain.

b. Price or market risk

Price risk reflects risks associated with changes in the price of output or of inputs that may occur after the commitment to production has begun. In agriculture, production generally is a lengthy process. Livestock production, for example, typically requires ongoing investments in feed and equipment that may not produce returns for several months or years. Both input and output price volatility are important sources of market risk in agriculture. Prices of agricultural commodities are extremely volatile. Output price variability originates from both endogenous and exogenous market shocks. Segmented agricultural markets will be influenced mainly by local supply and demand conditions, while more globally integrated markets will be significantly affected by international production dynamics.

In local markets, price risk is sometimes mitigated by the "natural hedge" effect, in which an increase (decrease) in annual production tends to decrease (increase) output price (though not necessarily farmers' revenues). In integrated markets, a reduction in prices is generally not correlated with local supply conditions, and therefore price shocks may affect producers in a more significant way. Another kind of market risk arises in the process of delivering production to the marketplace. The inability to deliver perishable products to the right market at the right time can impair producers' efforts. The lack of infrastructure and of well developed markets makes this a significant source of risk in many developing countries. Market risk can further be classified into- input price risk (risk associated with inputs or factors prices) and output price risk (risk associated with prices of the farm outputs)

i. Input price risk

In crop agriculture, input price risk has been considered less substantial than output price risk and yield risk. It does not translate into return

variability of the same magnitude. Moreover, the time window of input price risk is shorter: fertilizer and input costs are usually incurred within a few months of the onset of production, whereas the uncertainty around output price and yield usually remains for at least six months. However, the magnitude of input price fluctuations can be significant and there is no system in place to hedge against input prices (although there is the possibility of storing some items on the farm). Input price risk is still significant and may be overlooked.

Variability in fuel prices and in fertilizer prices appear to be the main components of input price variability in crop production, partly because fuel and fertilizer amount to most of the input costs in conventional agriculture, and partly because, as commodities themselves, they are subject to price fluctuations like all other commodities. These variabilities are expected to increase, in line with increased volatility of energy prices. With respect to the livestock sector, input costs amount predominantly to feed costs. Change in the price of feedstuffs can have significant effect on livestock production.

ii. Output price risk

Output price risk arises due to the biological lag inherent in agricultural production. Obviously, producers must make production decisions months (even years for tree crops) before they have a product to sell, before the actual crop prices are known. During this period, output prices may change dramatically in response to shocks in supply and demand. This may put farmers in a difficult situation if commodity prices decrease drastically during the production and marketing cycle.

Many factors are responsible to price changes. These factors include income and population growth, rising energy prices, and subsidised biofuel production have contributed to surging consumption of agricultural products. At the same time, productivity and output growth have been impaired by natural resource constraints, underinvestment in rural infrastructure and agricultural science, farmers' limited access to agricultural inputs and weather disruptions.

While speculation has been mentioned as a driver of price increases, the issue has been heavily debated but there is no conclusive evidence that speculation drove prices up. The consumption of cereals had also been consistently higher than production in previous years, which had reduced stocks. Stocks play a critical role indeed through their cushioning effect: low levels of stocks are associated with high price volatility. Macroeconomic factors also impact the volatility of agricultural prices, e.g. variability in inflation rates, exchange rates and interest rates.

The effect of shocks on the agriculture and food system is compounded by low elasticities of both supply and demand. Indeed, since food is an essential product with no substitute (apart from alternative foods), demand responses to price increases are typically low (until, for the poorest of all, it translates into hunger). Supply responses are also very low short-term, until production decisions can be made for the next season or more land brought into or taken out of production.

c. Institutional or regulatory risk

Institutional risk results from changes in policies and regulations that affect agriculture. This type of risk is generally manifested as unanticipated production constraints or price changes for inputs or for output. For example, changes in government rules regarding the use of pesticides (for crops) or drugs (for livestock) may alter the cost of production or a foreign country's decision to limit imports of a certain crop may reduce that crop's price. Other institutional risks may arise from changes in policies affecting the disposal of animal manure, restrictions in conservation practices or land use, or changes in income tax policy or credit policy.

d. Human or personal risks

Farmers are also subject to the human or personal risks that are common to all business operators. Disruptive changes may result from such events as death, divorce, injury, or the poor health of a principal in the firm. In addition, the changing objectives of individuals involved in the farming enterprise may have significant effects on the long-run performance of the operation.

e. Asset risk

This is also common to all businesses and involves theft, fire, or other loss or damage to equipment, buildings, and livestock. A type of risk that appears to be of growing importance is contracting risk, which involves opportunistic behavior and the reliability of contracting partners.

f. Financial risk

Financial risk results from the way the firm's capital is obtained and financed. A farmer may be subject to fluctuations in interest rates on borrowed capital, or face cash flow difficulties if there are insufficient funds to repay creditors. The use of borrowed funds means that a share of the returns from the business must be allocated to meeting debt payments. Even when a farm is 100-percent owner financed, the operator's capital is still exposed to the probability of losing equity or net worth. Price risk and production risks are usually considered the most important in agriculture and are discussed below. Policies are part of the solution in addressing these risks but are also associated with regulatory risks.

3.3.2 Other Classifications of Risks

Apart from being categorised according to their sources, risks can be classified according to the frequency of the occurrence of negative events and the magnitude of their impact.

i. Normal risk

Risks associated with frequent events which do not cause large losses are known as normal risks. These include risks such as normal fluctuations in prices and production. Normal risks are managed on the farm and by general government policies.

ii. Catastrophic risk

Events which are infrequent but lead to severe damage to a whole region (e.g. floods, droughts or pests and disease outbreaks) typically fall under the catastrophic risk layer, for which market solutions have played a less important role, mostly due to high public involvement. In developed countries, financial markets and insurance provide solutions to catastrophic risks while in Nigeria, State or federal government provides relief to affected farms/farmers via the national disaster relief agency.

iii. Idiosyncratic risk and systemic risk

Risks that affect few farms are known as idiosyncratic risk while risks that affect large number of farms are known as systemic risk. Examples of idiosyncratic risk are illness of the owner or laborers, acidic soil, particular plant and animal pests and diseases. Risks affecting a big population at the same time, like droughts or floods or price shocks, are more difficult to manage inside the sector. The high propensity for covariate risk in rural areas is a major reason that informal risk management arrangements breakdown and that formal financial institutions hesitate to provide commercial loans for agriculture (Jaffee, Siegel, and Andrews, 2010).

Self-Assessment Exercise

1: What is input price risk?

2. Many factors are responsible to price changes. Explain.

3.4 Conclusion

In this unit, you have learnt about the categories of risks. They include production risk, price risks and human or personal risks. Price risk and production risks are usually considered the most important in agriculture.

3.5 Summary

Production risk occurs because agriculture is affected by many uncontrollable events that are often related to weather. Price risk reflects risks associated with changes in the price of output or of inputs that may occur after the commencement of production, hence we price risks are of two types, the input price risk and output price risk. Financial risk is associated with the way firms source capital and finance their agribusiness.

3.6 References/Further Reading/Web Sources

Hardaker, J. B., Huirne, R. B. M. & Anderson, J. R. (1997). *Coping with Risk in Agriculture*. Wallingford: CAB International.

Jaffee, S., P. Siegel, & Andrews, C. (2010). *Rapid Agricultural Supply Chain Risk Assessment: A Conceptual Framework*. Washington, DC: World Bank.

Kay, R. D. (1981). *Farm Management: Planning, Control and Implementation.* McGraw-Hill.

3.7 Possible Answers to Self-Assessment Exercises

1. What is input price risk?

Input price risk: In crop agriculture, input price risk has been considered less substantial than output price risk and yield risk. It does not translate into return variability of the same magnitude. Moreover, the time window of input price risk is shorter: fertilizer and input costs are usually incurred within a few months of the onset of production, whereas the uncertainty around output price and yield usually remains for at least six months. However, the magnitude of input price fluctuations can be significant and there is no system in place to hedge against input prices (although there is the possibility of storing some items on the farm). Input price risk is still significant and may be overlooked.

Variability in fuel prices and in fertilizer prices appear to be the main components of input price variability in crop production, partly because fuel and fertilizer amount to most of the input costs in conventional agriculture, and partly because, as commodities themselves, they are subject to price fluctuations like all other commodities. These variabilities are expected to increase, in line with increased volatility of energy prices. With respect to the livestock sector, input costs amount predominantly to feed costs. Change in the price of feedstuffs can have significant effect on livestock production.

2. Many factors are responsible to price changes:

These factors include income and population growth, rising energy prices, and subsidized biofuel production have contributed to surging consumption of agricultural products. At the same time, productivity and output growth have been impaired by natural resource constraints, underinvestment in rural infrastructure and agricultural science, farmers' limited access to agricultural inputs and weather disruptions.

Unit 4 Effects of Risk in Agricultural Industry

Unit Structure

4.1 Introduction

The presence of risks in agriculture influences farm production and investment choices in a number of ways, including (a) the choices farmers make for the specific mix of commodities they produce and inputs used to produce these commodities; (b) strategies to manage and cope with risk; and (c) dynamic or investment impacts when the resolution of uncertainty results in a negative impact on farm incomes. The nature of the first two of these impacts on farm businesses will depend, principally, on the attitude of farmers towards risk. In general, farmers may be risk-averse (i.e. they dislike riskier outcomes), risk loving (prefer riskier outcomes) or risk neutral. However, studies within the agricultural sector have found that farmers tend to be averse to risk (OECD 2008); preferring outcomes that are more certain, although larger farms are relatively less risk-averse.

4.2 Learning Outcomes

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

- explain the consequences of risk on farm production
- highlight the effects of risk on investment in agricultural sector
- discuss the effects of risk on the welfare of farmers.

4.3 Main Content

4.3.1 Effects of Risk on Production

Of all the risk categories discussed in unit 3, price and production risks tend to influence farm production decisions most directly. In the absence

of instruments for managing risks, economic analysis of production under uncertainty often suggests that farmers will base their choices on some "expected outcome" (e.g. expected yield or price). Risk-averse producers will tend to prefer "low-risk and low-return" outcomes at the expense of higher payoffs that are more uncertain. In practice, this means that producers may choose low-risk production technologies and low risk crops at the expense of innovation and riskier choices that potentially offer higher returns. This will generally lead to a lower average income and lower levels of economic efficiency, as resources may not directed towards the most profitable farm enterprises.

This may be reflected in a reluctance of farmers to adopt new production techniques and technologies that may improve farm efficiency and profitability but result in some (perceived) increase in the variability of returns. Where support policies reduce income variability, either through direct payments or indirectly through, for example - market price support, farmers may be more willing to undertake riskier activities, effectively maintaining the riskiness of their portfolio. It is important to highlight here that it is not only the risk that output prices will be lower than expected ('downside' risk) that affects economic efficiency. Higher than expected prices ('upside' risk) has implications for economic efficiency, as a profit-maximising farmer would choose to produce more of a particular commodity at a higher price (assuming input costs and prices of other commodities are unchanged), reallocating resources towards the more profitable enterprise.

4.3.2 On-Farm Risk Management Strategies and Efficiency

There are several mechanisms for reducing or managing risks, however, agricultural producers may implement on-farm strategies to manage risk. Diversification of farm business income is one of the on-farm strategies of risk management. Diversification of this type redirects investment and labour time away from the farm towards off-farm activities, especially those generating income not strongly correlated with on-farm business income. To the extent that such diversification will compete for resources (e.g. labour time and capital) with agricultural production, it may reduce agricultural production or capacity.

Diversification can also occur at farm business level. In this case, rather than specialising in enterprises that gives the highest rate of return, the farm business is diversified to include other enterprises where returns are not positively correlated or that are less risky. However, this will result in a lower average income and lower economic efficiency, as resources are not directed towards the most profitable farm enterprises. In the face of increasing trade liberalisation, farmers may experience conflicting pressures arising from the need to specialise activities in order to exploit

production efficiencies and maintain competitiveness, while ensuring that risk exposure is minimised through on- and off-farm diversification. However, where risks can be managed efficiently and effectively through market-based risk management, businesses will be more able to specialise while mitigating the level of risk faced.

4.3.3 Impacts on Investment

While there are several risk management options available to farmers, these often only provide partial protection for potential losses. Where the remaining risk exposure causes returns and farm income to vary, and this variation is uncertain, it can make it difficult for farm businesses to plan long-term investment. For example, volatility in output prices can make it more difficult for farmers to identify trends in prices, which is often a basis for making long-term investment decisions. In the presence of such volatility, the level of investment by risk-averse producers is likely to be lower than in a risk free environment, which in turn has negative impacts on long-term productive capacity in agriculture.

In addition, where unexpected shocks result in significant income losses, this can constrain future farm investments. This is largely a product of inefficient credit markets; otherwise, farm businesses should be able to borrow to smooth their income for any fluctuations. The impacts of risk on investment described above accounts for how levels of input use, output and investment in agriculture may fall below optimal levels in a production environment characterised by risk or uncertainty.

4.3.4 Effect of Risk on Welfare of Producers

Risk has a negative effect on welfare. Under the situation of isolated markets, there is a negative correlation between the individual's own production and the market price. The expected profit will be lower under uncertainty than under certainty. This is because a year of bumper harvest for an individual farmer corresponds with a year of bumper harvest for most other farmers thus resulting in a fall in the local market price. Since the producer receives a low price whenever output is high, and a higher price when output is low, for average production the farmer receives a price lower than the average price. This implies that risk affects even the welfare of risk-neutral farmers.

Farm households can raise their agricultural output, earnings and productivity by: increasing land under cultivation, applying more purchased inputs, hiring more labor and equipment, switching from subsistence to higher value cash crops, or by selling a greater proportion of crop yield. These methods, however, expose them to more risks since output or market prices may fall below expected levels. The farm

household decision in such a situation will depend on its assessment of the risks involved and its capacity to withstand the losses should the outcome turn out bad.

Self-Assessment Exercise

1: Explain the impacts on Investment.

2. Who is a risk averse producer?

4.4 Conclusion

In this unit, you have learnt that risks will impinge on welfare of farmers by reducing productivity and efficiency vis-à-vis net returns to farmers.

4.5 Summary

In this unit, we have considered the effect of agricultural risks on farm production, investment and welfare of farmers and farming households.

4.6 References/Further Readings/Web Sources

Treasury, H. M. (2003). "The Green Book: Appraisal and Evaluation in Central Government." Retrived from http://www.hm-treasury.gov.uk/data_greenbook_index.html.
Vrolijk, *et al*. (2009). *Volatility of Incomes, Prices and Yields in the European Union*. The Hague: LEI Wageningen UR.

4.7 Possible Answers to Self-Assessment Exercises

1: Explain the impacts on Investment

While there are several risk management options available to farmers, these often only provide partial protection for potential losses. Where the remaining risk exposure causes returns and farm income to vary, and this variation is uncertain, it can make it difficult for farm businesses to plan long-term investment. For example, volatility in output prices can make it more difficult for farmers to identify trends in prices, which is often a basis for making long-term investment decisions. In the presence of such volatility, the level of investment by risk-averse producers is likely to be lower than in a risk free environment, which in turn has negative impacts on long-term productive capacity in agriculture.

In addition, where unexpected shocks result in significant income losses, this can constrain future farm investments. This is largely a product of inefficient credit markets; otherwise, farm businesses should be able to

borrow to smooth their income for any fluctuations. The impacts of risk on investment described above accounts for how levels of input use, output and investment in agriculture may fall below optimal levels in a production environment characterised by risk or uncertainty.

2. Risk-averse producers will tend to prefer "low-risk and low-return" outcomes at the expense of higher payoffs that are more uncertain. In practice, this means that producers may choose low-risk production technologies and low risk crops at the expense of innovation and riskier choices that potentially offer higher returns. This will generally lead to a lower average income and lower levels of economic efficiency, as resources may not directed towards the most profitable farm enterprises.

Unit 5 Risk Attitudes of Farmers

Unit Structure

5.1 Introduction

Risk management strategies are also affected by an individual's ability to bear (or to take) risk. Simply stated, risk bearing ability is directly related to the solvency and liquidity of one's financial position. Risk bearing ability is also affected by cash flow requirements. Cash flow requirements are the obligations for cash costs, taxes, loan repayment, and family living expenses that must be met each year. The higher these obligations as a percentage of total cash flow, the less able the farm firm is to assume risk. On the basis of attitudes to risk, farmers can be classified in the following risk-taking categories:

5.2 Learning Outcomes

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

- explain the risk attitudes of farmers
- state the determinants of risk attitudes
- discuss the implications of each category of risk attitudes on adoption of innovation.

5.3 Main Content

5.3.1 Categories of Risk Attitudes of Farmers

On the basis of attitudes to risk, farmers can be classified into the following risk-taking categories:

- Risk Averters
- Risk Neutral
- Risk Seekers
- Risk Tolerant

Risk Averters

The risk averters or ("Avoiders") are those individuals who have the attitude of taking appropriate measure to avoid incurring risk or the outcomes of risky events. Risk-averse people are not comfortable with risks; they are willing to avoid the risks, once identified, rather than taking them. Therefore, to be risk averse implies that an individual is not willing to stake in excess of the expected return in exchange for some certainty about the future. For instance, a risk averse farmer will not respond positively to new innovation such as new variety of crops, herbicides or any other agrochemicals. Such farmers will delay adoption until they have seen the profitability of such risk-taking by the neighbouring farmers. Risk averters are laggards in adoption of innovation.

Risk Neutral

Risk-neutral people manage risks based on their expected value, that is, probability time's impact. In other words, their decisions towards risks are not biased by any other factors, except for the risks' expected value. A person willing only to pay the average loss as a premium would be considered risk neutral. Risk neutral people are also known as"Calculators". "Calculators" understand they must take some chances to get ahead, but they recognise that there are degrees of risk in every situation. Before making a decision or taking action, they gather information and analyse the odds. Calculators try to be realistic, recognise the risks, and try to reduce risks to acceptable levels. Most farmers are Calculators, at least in the majority of their decisions. It means that such farmers are not ready to assume risk and at the same time not prepared to stake more than necessary in preventing risk or transferring the loss to an insurance company.

The pertinent issue at this juncture is- what makes one person to be more risk averse than another? This issue borders on the realm of psychology or sociology, or anthropology. Nevertheless, it can be assumed that factors such as family and societal influences, genetics, religious and philosophical beliefs all play an important role.

Risk Seekers

Risk-seeking people see risks as challenges and feel exciting dealing with them. A farmer or farm manager who accepts risk at less than the expected average loss, perhaps even paying to add risk is a risk seeker. Risk seekers are also known as adventurers. Adventurers are individuals who enjoy risks. To Adventurers, risks are challenging and exciting. Often Adventurers look for the chance to take risks. Adventurers differ in their mental outlook. Some risk seekers enjoy the excitement of risk taking, but keep the stakes to reasonable levels. Many farmers may be in this category with respect to their marketing plans. As long as financial survival is not at stake, they may enjoy the adventure of playing the market. Many

speculators are in this category. However, some Adventurers may get in over their heads. This may be from peer pressure or from a change in external conditions.

Risk Tolerant
Risk-tolerant people are indifferent about risks. This means they do not pay much attention to risks, until these risks become real problems. The level of comfort of these categories of farmers to risks is very near the line zero.

5.3.2 Determinants of Farmers' Risk Attitudes

Age of the farmers
Age was found to be inversely related to risk-averse attitude. This implies that the lower the age of the farmer, the more risk averse he/she will be. Older farmers are more likely to have accumulated more wealth than younger farmers. Also older farmers are more likely to have greater social capital and incentives which can serve as some form of traditional insurance or fall-back strategies in the process of decision making.

Household size
The larger the household size, the greater will be the total consumption needs of the farm family and hence, the more risk-averse behaviour a farmer would put up. This implies that household size tends to reduce the probability of risk neutrality in spite of the large family size. Studies have revealed a negative relationship between household size and risk averse attitude. This implies that majority of the households might get household members assisting on the farm by supplementing its labour supply especially during peak periods (e.g. weeding and harvest times) of labour requirement.

Educational status
The willingness of farmers to take risks tends to increase with increase in the level of education. In other word education increases the risk neutrality of farmers and reduces the risk aversion. The positive correlation between educational status of farmers and willingness to bear risk is based on the knowledge acquisition which helps such farmers to understand the nature of risk and the various technologies available to mitigate it or cope with the risk. This knowledge is absent in illiterate farmers, hence most of them are risk averters.

Access to credit
Access to credit by farmers is another determinant of risk attitudes of farmers in Nigeria and by extension in other less developed countries. Access to credit is inversely related to risk attitudes. This implies that the more credit support is given to farmers, the less risk averse the farmers

will become. This is because the financial support will enhance farmers' access to technological learning and improved production inputs that will lead to increased productivity. Thus, depriving farmers of access to micro financial services will make them prone to being more risk averse.

Family/Farm income

Financial status of the food crop farmers- all things being equal, has positive and significant relationship with risk-averse attitude of food crop farmers. This stands to reason that the lower a household's income or poorer the house-hold, the more risk averse it will be. Hence, all other things being equal, households whose incomes fall below the poverty line would be less willing to take risk than those whose incomes are higher.

Mode of land acquisition

Farm lands can be acquired by inheritance, purchase and leasing. The most common mode of land acquisition by farmers in developing countries is inheritance. This mode of land acquisition (inheritance) increases the probability of risk seeking of the respondents. Since the land is not purchased, the farmer can afford to use it as surety or guarantee for any risky transaction.

Total investment

Farm's total investment is one of the factors that determine the willingness of a farmer to bear risks. Capital accumulation and increase in farm assets of the farm enterprise attracts higher risk, hence the farmer must indulge in certain risky enterprises. In such circumstances, risk seeking attitude is a natural course. The risk bearing ability is directly related to the solvency and liquidity of one's financial position. The higher the net worth (or owner's equity) of a farm/firm, the greater the ability of such a farm to bear risk. Risk bearing ability is also affected by cash flow requirements. Cash flow requirements are the obligations for cash costs, taxes, loan repayment, and family living expenses that must be met each year. The higher these obligations as a percentage of total cash flow, the less able the farm firm is to assume risk.

Membership of cooperative society

Membership of cooperative society gives farmers access to credit at low interest rate. It is therefore expected that membership of cooperative society should increase the risk seeking ability of the farmers. It is thought that when farmers associate with members in similar social and economic status, the knowledge base for dealing with risks associated with agricultural production environment is enhanced thus boosting risk seeking abilities but the contrary has been the case. This might be due to fear of investing acquired loans in risky enterprises which will make them to default payment, thereby losing his or her integrity.

Self-Assessment Exercise

1: Distinguish between risk seeker and risk tolerant.

2. How does age determine farmers' risk attitudes?

5.4 Conclusion

The attitude to risk differs from one individual to another. The different postures towards risk are determined by socio-economic characteristics of the farmers as well as the farm's characteristics. The risk attitude Influence the rate of adoption of innovation vis-a-vis the farmers' income.

5.5 Summary

In this unit, we have discussed the risk attitudes of farmers and the determinants of their risk behaviour. Farmers are classified into three categories-Risk averters, Risk Neutral and Risk Seekers The determinants of risk status of farmers include age, sex, income, mode of land acquisition etc.

5.6 References/Further Reading/Web Sources

Salimonu, K.K., Falusi, A.O. (2009). 'An Empirical Analysis of Attitude towards risk and the influence of socio-economic and demographic factors among food crop farmers in Osun State, Nigeria'. *International Journal of Applied Agricultural and Apicultural Research*, 5(1), 32-43.

5.7 Possible Answers to Self-Assessment Exercises

1: Distinguish between risk seeker and risk tolerant.

Risk Seekers: Risk-seeking people see risks as challenges and feel exciting dealing with them. A farmer or farm manager who accepts risk at less than the expected average loss, perhaps even paying to add risk is a risk seeker. Risk seekers are also known as adventurers. Adventurers are individuals who enjoy risks. To Adventurers, risks are challenging and exciting. Often Adventurers look for the chance to take risks. Adventurers differ in their mental outlook. Some risk seekers enjoy the excitement of risk taking, but keep the stakes to reasonable levels. Many farmers may be in this category with respect to their marketing plans. As long as financial survival is not at stake, they may enjoy the adventure of playing the market. Many speculators are in this category. However, some Adventurers may get in over their heads. This may be from peer pressure or from a change in external conditions.

Risk Tolerant: Risk-tolerant people are indifferent about risks. This means they do not pay much attention to risks, until these risks become real problems. The level of comfort of these categories of farmers to risks is very near the line zero.

2. Age of the farmers:

Age was found to be inversely related to risk-averse attitude. This implies that the lower the age of the farmer, the more risk averse he/she will be. Older farmers are more likely to have accumulated more wealth than younger farmers. Also older farmers are more likely to have greater social capital and incentives which can serve as some form of traditional insurance or fall-back strategies in the process of decision making.

Module 3 Risk Management

Unit 1 Meaning and Scope of Risk Management

Unit Structure

1.1 Introduction

The sources of risk in agriculture are numerous and diverse. The markets for agricultural inputs and outputs have a direct incidence on farming risk, particularly through prices. A diversity of hazards related to weather, pests and diseases or personal circumstances determine production in ways that are outside the control of the farmer. Unexpected changes may occur in access to credit or other sources of income that affect the financial viability of the farm. To combat these myriads of risks in agriculture, there is the need for farmers, farm managers to understand the meaning and scope of risk management.

1.2 Learning Outcomes

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

- explain risk management
- identify the threefold approach to risk management
- state the principles of risk management.

1.3 Main Content

1.3.1 Meaning of Risk Management

There are arrays of definitions of risk management; some of them are presented here. Risk management is a mechanism for managing exposure to risk that enables us to recognise the events that may result in unfortunate or damaging consequences in the future, their severity, and how they can be controlled. Risk management is a discipline for identifying risks, assessing how serious or severe the risks are, and determining ways to address that uncertain future with a goal of avoiding or minimising harm and financial losses. Risk management is the continuing process to identify, analyse, evaluate, and treat loss exposures and monitor risk control and financial resources to mitigate the adverse effects of loss. A working definition of risk management that applies generally and not specifically to agriculture could be: the identification, analysis, and economic control of those risks which can threaten the assets or earning capacity of an enterprise.

Several important points emerge from these definitions:

(1) The threefold approach to risk management is quite evident. Risks must be identified before they can be measured, and only after their impact has been assessed can we decide what to do with them.
(2) The eventual control mechanism, whatever it is, must be economic. There is no point in spending ₦100, 000 to control a risk which can only ever cost you ₦50, 000. There will always be a point where spending on risk control has to stop.
(3) The definition mentions assets and earning capacity. These assets can of course be physical or human. They are both important, and risk management must be seen to have a part to play in both. However, risks do not only strike at assets directly, and for this reason the definition mentions the earning capacity of an enterprise.
(4) The definition uses the word enterprise rather than a more restrictive word such as company or manufacturer. Risk management has its origins in manufacturing or process industries, but the principles are just as applicable in the agricultural sector as the manufacturing sector and are of equal importance in the public and private sectors of the economy. Reference to "earning capacity" does not automatically imply the private sector and the profit motive.
(5) Finally, the definition is couched in terms which support the expected objectives of the enterprise. Risk management should be viewed as a positive way of helping operational managers to achieve their objectives. It is by identifying, measuring, and

controlling risk, assets' earning capabilities, and hence, the objectives of the enterprise will be secured.

In ideal risk management, a prioritisation process is followed whereby the risks with the greatest loss (or impact) and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled in descending order. In practice the process of assessing overall risk can be difficult, and balancing resources used to mitigate between risks with a high probability of occurrence but lower loss versus a risk with high loss but lower probability of occurrence can often be mishandled.

Risk management also faces difficulties in allocating resources. This is the idea of opportunity cost. Resources spent on risk management could have been spent on more profitable activities. Again, ideal risk management minimises spending (or manpower or other resources) and also minimises the negative effects of risks.

Intangible risk management identifies a new type of a risk that has a 100% probability of occurring but is ignored by the organisation due to a lack of identification ability. For example, when deficient knowledge is applied to a situation, a knowledge risk materialises. Relationship risk appears when ineffective collaboration occurs. Farmers that do not interact and collaborate with other farmers in the neighbourhood will not have access to helpful information at the right time if at all he does, hence, he will be exposed to relationship risks.

Process-engagement risk may be an issue when ineffective operational procedures are applied. These risks directly reduce the productivity of farmers, family and hired labour, decrease cost effectiveness, profitability, service, quality, reputation, brand value, and earnings quality. Intangible risk management allows risk management to create immediate value from the identification and reduction of risks that reduce productivity.

1.3.2 Principles of Risk Management

The following are the principles of risk management.

1. Risk management should create value for the farmers. This implies that the resources expended to mitigate risk should be less than the consequence of inaction. In other words, the gain of risk management should exceed the pain. A farmer should not spend one hundred thousand naira ₦100,000 to control pest in a farm in which the net farm income is fifty thousand naira ₦50,000.00. Risk managers are measured and judged on a number of different

dimensions, but the only dimension that matters is how it impacts the value of the business. Good risk management increases value, whereas bad risk management destroys value.

2. Risk management must be an integral part of organizational processes. This principle signifies that risk management must be part of the processes that are involved in crop production or livestock enterprise.
3. It must be part of decision making process. Farmer as an entrepreneur is a decision maker. In the course of making decision on or before investment in planting season or livestock production, management of expected risk must be planned for and appropriate strategies be put in place to mitigate or avoid the risk. For instance, at the time a poultry farmer is making a decision to acquire or purchase day–old chicks, it is expected that part of the decision process should be how to avoid breaking out of disease and to achieve this; he makes plan to vaccinate the chicks at regular intervals.
4. It must explicitly address uncertainty and assumptions.
5. Risk management should be based on the best available information. Some risks could be avoided if farmers have access to information. Hence, farmers should seek for information from co-farmers and more importantly from the extension agents. The farmers should utilise the acquired information by carrying out the risk management on the premise of the best available information.
6. It must take human factors into account. Two out of the four factors of production (labour and entrepreneur) are human factors. The actions or inaction of these two factors constitute a major source of risk in any business enterprise. It is therefore imperative for risk management process to take into consideration the human factors. The death of a farmer or farm manager of an agribusiness enterprise or the withdrawals of service by farm workers are human based risk which must be planned for in risk management strategies.
7. **Risk is threat and opportunity**- Risk is the combination of danger and opportunity. Market volatility can ruin you or make you wealthy. Changing customer tastes can lay your entire market to waste or allow you to dominate a market. Business failures and large losses come from exposures to large risks but so do large profits and lasting successes. The trouble with risk management is that people see one side or the other of risk and respond accordingly. Those who see the bad side of risk, i.e. the danger side, either argue that it should be avoided or push for protection (through hedging and insurance) against it. On the other side are those who see risk as upside and argue for more risk taking, not less. Risk is a mix of upside and downside. Good risk management

is not about seeking out or avoiding risk, but about maintaining the right balance between the two.

8. Risk is a combination of potential upside with significant downside and requires a more nuanced approach. If we accept the proposition that we cannot have one (upside) without the other (downside), we can become more realistic about how we approach and deal with risk. We can also move towards a consensus on which risks we should seek out, because the upside exceeds the downside, and which risks are imprudent, not because we do not like to take risk but because the downside exceeds the upside.
9. It must be dynamic, iterative and responsive to change. Risk management must not be static rather it should be dynamic. A farmer who is rigid and traditional in his approach, not ready to adopt innovations such as new variety of crops that are resistant to certain pest might suffer losses. Farmers should therefore be responsive to changes that are taking place in agricultural industry.
10. Risk management portfolio must be capable of continual improvement and enhancement.
11. Risk management must be continually or periodically reassessed. Risk management process includes monitoring and evaluation. The farmers is expected to assess the risk management strategies continually in terms of quality and cost by weighing the cost of risk management the value created in terms of net farm income. The outcome of the assessment or evaluation will indicate the next line of action, which could be adhering to the existing risk management portfolios or adopt a new and better risk management strategies.

Self-Assessment Exercise

1: Risk is threat and opportunity. Discuss.
2. What is intangible risk management?

1.4 Conclusion

Risk management is the identification, analysis, and economic control of those risks which can threaten the assets or earning capacity of an enterprise. Risks must be identified before they can be measured, and only after their impact has been assessed can we decide what to do with them.

1.5 Summary

In this unit, meaning and scope of risk management as well as the principles of risk management are considered.

1.6 References/Further Readings/Web Sources

Government of India. *Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012)*. New Delhi: Government of India Planning Commission.

Hardaker, J.B. (2000). "Some Issues in Dealing with Risk in Agriculture." Working Paper Series in Agricultural and Resources Economics. Australia.

1.7 Possible Answers to Self-Assessment Exercises

1: Risk is threat and opportunity. Discuss.

Risk is the combination of danger and opportunity. Market volatility can ruin you or make you wealthy. Changing customer tastes can lay your entire market to waste or allow you to dominate a market. Business failures and large losses come from exposures to large risks but so do large profits and lasting successes. The trouble with risk management is that people see one side or the other of risk and respond accordingly. Those who see the bad side of risk, i.e. the danger side, either argue that it should be avoided or push for protection (through hedging and insurance) against it. On the other side are those who see risk as upside and argue for more risk taking, not less. Risk is a mix of upside and downside. Good risk management is not about seeking out or avoiding risk, but about maintaining the right balance between the two.

2. **Intangible risk management** identifies a new type of a risk that has a 100% probability of occurring but is ignored by the organisation due to a lack of identification ability. For example, when deficient knowledge is applied to a situation, a knowledge risk materialises. Relationship risk appears when ineffective collaboration occurs. Farmers that do not interact and collaborate with other farmers in the neighbourhood will not have access to helpful information at the right time if at all he does, hence, he will be exposed to relationship risks.

Unit 2 Risk Management Process and Benefits of Risk Management

Unit Structure

2.1 Introduction

The management of risk involves a process which is indicative of the fact such task is not expected to be taken casually by the farmers or his representative if the end result is to be beneficial to the farmers and the business enterprise. This is in view of the fact that the essence of risk management calls actions such as risk identification, risk assessment, evaluation of risk and above all, determining the appropriate strategies with which to manage them. This unit, therefore, focuses on discussing the necessary process of risk management.

2.2 Learning Outcomes

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

- discuss the risk management process
- explain components of risk management process
- state the benefits of risk management process to farmers and national economy.

2.3 Main Content

2.3.1 Objectives of Risk Management Process

Risk management is a process which provides the assurance that:

- objectives are more likely to be achieved
- damaging things will not happen, or are less likely to happen
- beneficial things will be, or are more likely to be achieved
- losses will be reduced

- income variability will be reduced if it cannot be totally eliminated.

Risk management is not a process for avoiding risk. The aim of risk management is not to eliminate risk, rather to manage the risks involved in all farming activities to maximise opportunities and minimise adverse effects. Risk management is not the management of insurable risks. Insurance is an important way of transferring risk but most risks will be managed by other means.

2.3.1.1 Steps in Risk Management Process

The risk management concept enables a systematic and realistic framework to be established for accident prevention. It refers to the whole process of:

- risk identification
- risk estimation
- risks evaluation
- control measures establishment, and
- implementation of control measures.

This risk management process can be further divided into two distinct stages. The first stage concerns with the understanding of the "problems" (fact finding); while the second stage concerns with the "solutions" to the problems. The first stage encompasses the processes of risk identification, and risk assessment while the second stage encompasses the process of risk evaluation, establishment of control measures and implementation of control measures.

1. Risk Identification

The first step in risk management is risk identification. Knowing and appreciating the risks one faces is critical to designing effective management responses. The objective is to reveal all possible potentials for harm or damage that exist in a particular agricultural production or enterprise being analysed. If this step is not conducted properly, the whole risk management scheme would be affected.

Such identification actions by the organisation are focused on generating relevant information on sources of risk, hazards, risk factors, perils and exposure to loss.

In order to properly recognise the operational risks of a particular farm enterprise there is the need for farmers or farm manager to have thorough knowledge of

- the farm enterprise (crop farming, livestock, aquaculture, apiculture etc)
- the market in which it operates
- the legal, social, economic, political and climatic environment in which it does its business
- the financial strengths and weaknesses of the crop or livestock enterprise
- its vulnerability to unplanned losses
- the production and management systems of enterprise.

Many analytical methods have been developed for use in hazards identification. The appropriate method or mix of methods should be selected to enable the process be conducted "systematically" to achieve a better coverage of hazards.

2. Risk Estimation

A second step is to measure the likelihood the risk will occur and the potential negative impact by assigning probabilities and outcomes. This is a particularly difficult step because of the subjective nature of many of these measurements. However, this only underscores the importance of accurately measuring those variables for which reliable, objective measures are available. After risks have been identified, they will need to be further analysed to define the effects of risks on production and farmer’s income.

Risk estimation will provide information on the relative severity of the various risks, the crops or animals or other aspect of the agricultural production that will be affected and thereby signify the enterprises and the assets that must be protected or people to whom protections have to be provided. As previously defined, risk is "a measure of the probability and severity of adverse effects". Therefore, in the "risk estimation process", the consequences as well as the probability of occurrence of those hazards identified are assessed.

3. Risk Evaluation (Acceptability Evaluation)

The third step in risk management process is risk evaluation. Risk evaluation is the making of an overall judgment on the importance of a risk, to determine its acceptability. On the basis of risk estimation, an evaluation is then made as to whether the risk is acceptable or additionally safety measures are necessary to reduce the risk to an acceptable level. Risk assessment is very much a subjective judgment. However, by following certain principles, the subjectivity in risk assessment can be minimised.

4. Establishment of Control Measures

Risks can normally be reduced through one or several safety measures. The reduction can apply to either the consequences or the probability that they will occur. The control measures may be by ways of "engineering control" or "administrative" controls. "Engineering Controls" refer to hardware such as guards, barriers or contour against erosion. "Administrative Controls" refer to software issues such as safe working procedures, safety systems e.g. crop rotation, use of organic fertilizer instead of inorganic fertilizers etc.

5. Implementation of Control Measures

Appropriate control measures are put to work at this stage. It may take a long while to implement the measures because considerable time may be needed for training, equipment purchases, installation work, and often the need for overcoming resistance to change. The process of risk management as mentioned above is a continuous process which is never ending. Some risk may have been overlooked and need further identification and new risks may be introduced in the course of time and the whole process will have to be performed again. Furthermore, the residual risk of certain risks may also need to be assessed to evaluate their acceptability after appropriate control measures have been implemented.

2.3.2 Benefits of Risk Management

The benefits of risk management can be viewed from three angles; the benefits of risk management to- the farm enterprise, national economy and to farmers and farm workers are considered below.

Benefits of risk management to the farm enterprise

(i) An effective risk management supports strategic and enterprise planning
(ii) It supports effective use of resources
(iii) Risk management promotes continuous improvement in agricultural production
(iv) Risk management enables farm enterprise to quickly grasp new opportunities
(v) It helps internal audit each farm enterprise
(vi) It improves credit status of the farm business.

Benefits of risk management to national economy

(i) The benefits accruing to the various farm business enterprise will invariably enhance the positive development of the national economy.
(ii) An effective risk management will increase foreign exchange earnings from agricultural sector, and thereby reduce our nation’s dependence on food imports and other agricultural products.

(iii) Efficient risk management will reduce wastage in the farm and in relation to damage and destruction of farm equipment.

Benefits of risk management to farmers and workers

(i) Risk management will result in higher productivity of the farmers, the family labour and hired labour.
(ii) Higher productivity of the farmers and the labour force will in turn increase the gross national product of the economy.
(iii) The farmers and the hired workers are guaranteed a tranquility of mind; and his needs, wants and aspirations are guaranteed because pains, sickness, injury and property loss associated with operational risks are reduced to bearable limits.

Self-Assessment Exercise

1: Mention 6 benefits of risk management to the farm enterprise.
2. What is risk identification?

2.4 Conclusion

In this unit, we have considered the risk management process, which involves a process executed in a well-defined manner in order to ensure the best interest of the farm business. Risk management calls for actions such as risk identification, risk evaluation/measurement, treatment of risk, risk control, and risk financing. In addition, risk process is a continuous exercise, hence farmers must ensure that the risk process is monitored and review on periodic basis towards achieving desired result.

2.5 Summary

In this unit, we have studied risk management process and benefits of risk management process. The risk management process are risk identification, risk assessment/estimation, risk evaluation, establishment of control measures and implementation of identified control measures. The benefits of risk management process are viewed from the angles of the farm business, the farmers and the workers, that is, the family labour and hired labour.

2.6 References/Further Readings/Web Sources

Hardaker, J.B. (2000). "Some Issues in Dealing with Risk in Agriculture." Working Paper Series in Agricultural and Resources Economics. Australia.

2.7 Possible Answers to Self-Assessment Exercises

1. Mention 6 benefits of risk management to the farm enterprise

i. An effective risk management supports strategic and enterprise planning
ii. It supports effective use of resources
iii. Risk management promotes continuous improvement in agricultural production
iv. Risk management enables farm enterprise to quickly grasp new opportunities
v. It helps internal audit each farm enterprise
vi. It improves credit status of the farm business.

2. Risk identification

The first step in risk management is risk identification. Knowing and appreciating the risks one faces is critical to designing effective management responses. The objective is to reveal all possible potentials for harm or damage that exist in a particular agricultural production or enterprise being analysed. If this step is not conducted properly, the whole risk management scheme would be affected.

Module 4 Strategies in Risk Management

Unit 1 Enterprise Diversification and Vertical Integration as Risk Mitigation Methods

Unit Structure

1.1 Introduction

Risk is an important aspect of the farming business. The uncertainties of weather, yields, prices, government policies, global markets, and other factors can cause wide swings in farm income. Risk management involves choosing among alternatives that reduce the financial effects of such uncertainties. Farmers have many options for managing the risks they face, and most producers use a combination of strategies and tools. Some strategies deal with only one kind of risk, while others address multiple risks.

Risk management in agriculture is now an essential tool for farmers to anticipate, avoid and react to shocks. An efficient risk management system for agriculture will preserve the standard of living of those who depend on farming, strengthen the viability of farm businesses, and

provide an environment which supports investment in the farming sector. There are three recognised management strategies for responding to risks. These can be described as:

(a) risk mitigation
(b) risk coping
(c) risk transfer/risk sharing.

A fourth approach is that of **risk avoidance** or **risk prevention**. However, this is rarely possible in agricultural production, especially in developing countries where there are very few alternative sources of nonfarm employment.

Risk mitigation is a strategy that is adopted before the occurrence of risk in the farm. Risk mitigation is all methods used to decrease the adverse effects of the particular risk. Mitigation methods are referred to as Exante strategies. Mitigation methods include reducing the risk itself, reducing expose to the risk and introducing practices which allow adaptation to the risk. Enterprise diversification and vertical integration are farm practices that can be used as risk mitigation methods.

1.2 Learning Outcomes

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

- define mitigation
- explain enterprise diversification as means of risk mitigation
- discuss vertical integration and explain its use as risk mitigation method.

1.3 Main Content

1.3.1 Enterprise Diversification

Diversification is a frequently used extant risk management strategy that involves participating in more than one activity. Diversification is an effective way of reducing income variability. It is the combining of different production processes. Effective diversification occurs when low income from one enterprise is offset by satisfactory or high incomes from other enterprises. It typically reduces large year-to-year variations in income and may ensure adequate cash flow for meeting production costs, debt obligations, and family living needs. However, acquiring new overall knowledge about an alternative business, new crop production expertise, and new equipment for a new crop may be costly. Expanding into new areas or experimenting with new crops will increase capital investment requirements. For instance, diversification can include different crops, combinations of crops and livestock, different end points in the same

production process (such as different selling weights), or different types of the same crop.

The motivation for diversifying is based on the idea that returns from various enterprises do not move up and down in lockstep, so that when one activity has low returns, other activities likely would have higher returns. A crop farm, for example, may have several productive enterprises (several different crops or both crops and livestock), or may operate disjoint parcels so that localised weather disasters are less likely to reduce yields for all crops simultaneously. Many crop farms in less developed countries engage in mixed cropping. For example, they produce maize and melon, maize and cassava, maize, cassava, yam and vegetables. By producing two or more crops instead of only one, the farm is less at risk of having low revenues because revenues from the two crops are not perfectly, positively correlated. In some years, low maize revenues may be counterbalanced by relatively high melon revenues.

Planting maize and melon or cowpea for instance will not only reduce variability in income, it may reduce the fertilizer requirement of the soil because of the nitrogen-fixing properties of bacteria that resides in the root nodules of cowpea plants. It may spread out labor and machine use over critical times in the planting and harvesting seasons. In situations where livestock is part of the enterprise mix, the operator may be kept busy throughout the year, and crop and animal by-products may be used more fully.

Through crop diversification, as a production risk management tool, farmers and ranchers may acquire another marketing tool, providing another way to enhance profitability. Direct marketing of the diversified crop to consumers is becoming much more common, including farmers' markets, roadside stands, and community-supported agriculture arrangements. The benefits of diversifying income sources depend on the variability of returns faced by a producer. Diversification can also be achieved by having several income sources, such as on-farm businesses and off-farm income (employment, investments or savings), to help counter negative fluctuations in farm income.

Many factors may contribute to a farmer's decision to diversify. The underlying theory suggests that farmers are more likely to diversify if they confront greater risks in farming, are relatively risk averse, and face small reductions in expected returns in response to diversification. Some factors can work against diversification in crops. For example, corn and soybeans use similar machinery and equipment, but many specialty crops which can be grown may require special equipment. Thus the benefits of diversification may be offset by increased costs. Other crop enterprises may provide very low returns to capital, labor, and management.

Although variability could be reduced by including these enterprises in the farm business, most farmers are unwilling to accept the reduced income which also results.

1.3.2 Vertical Integration

Vertical integration is a type of management control. It is a mitigation method of risk management that is used to reduce the effect of production risk in agriculture. It is similar to enterprise diversification but they are different to a very large extent. While enterprise diversification can involve combination of related and unrelated enterprises, vertical integration involves the combination of two or more related enterprises. It is one of the alternative methods of coordinating management and control of farm production from farm supplier to ultimate consumer. Vertical integration can be defined as the combination of two or more stages of a production marketing chain under single ownership. Vertical integration could be in two forms:

1. **Backward integration:** this occurs when a firm decides to make rather than buy an input from an independent supplier. In other words, firm is said to be backward integrated has control over the supply of its inputs.
2. **Forward integration:** this occurs when a firm decides to use rather than sell one of its products to independent customers. Conversely, vertical disintegration involves a decision to buy rather than make an input or to sell rather than use an input. Backward integration could be a case whereby a poultry farm produced its feed by acquiring a feed mill and the forward integration signifies a poultry farm that acquire its inputs from the upstream but combines distribution with production.

Vertical integration generally decreases risk associated with the quantity and quality of inputs or outputs because the vertically integrated firm retains ownership or control of a commodity across two or more phases of production and/or marketing. There are many examples of vertical integration in farming. Farmers who raise corn and hay- as feed for their dairy operations, are vertically integrated across both crop and livestock production. Similarly, cattle producers who combine raising a cow-calf herd, back-grounding the animals to medium weights, and feeding cattle to slaughter weights are vertically integrated. Poultry farmers with large operations may own their own feed mill, hatchery, laying operation, and freezing/drying plant for the processing of egg products and chicken.

The decision to integrate vertically depends on many complex factors, including the change in profits associated with vertical integration, the risks associated with the quantity and quality of the supply of inputs (or

outputs) before and after integration, and other factors. In particular, the relationship between vertical integration and risk involves an evaluation of the expected returns and the variance and covariance of the farmer's return on investment for the current activity and the integration alternative. If the correlation is positive and large across activities, the gains in risk efficiency from vertical integration may be relatively low. In contrast, a negative correlation across activities implies that integrating vertically may well reduce risk for the farmer by internalizing processes within the operation.

1.3.2.1 Benefits of Vertical Integration

Vertical integration as a risk mitigation method, potentially, offers the following advantages:

1. Vertical integration reduces transportation costs and risk associated with transporting inputs and outputs if common ownership results in closer geographic proximity.
2. It Improves supply chain coordination.
3. Firms may integrate as a risk reduction strategy.
4. Vertical integration as a risk management strategy minimises losses and costs thereby increase the profitability of business enterprises.
5. It provides more opportunities to differentiate by means of increased control over inputs.
6. Entrepreneur and the farmers can guarantee the quality of inputs.
7. It ensures adequate and timely supply of inputs.

1.3.2.2 Drawbacks of Vertical Integration

While some of the benefits of vertical integration can be quite attractive to the firm, the drawbacks may negate any potential gains. Vertical integration potentially has the following disadvantages:

1. Vertical integration requires high level of capital investment. For instance, a poultry farm that integrates backward is expected to acquire feed mill and produce the maize to feed the mill.
2. The profitability advantage of vertical integration is often limited by scale and scope incompatibility and under utilisation of machineries. This problem will occur, for instance, in a vertically integrated poultry farm if the capacity of feed mill is greater than the feed requirements of the poultry farms. This is a capacity balancing issue and is also known as unbalanced throughput.
3. Potentially higher costs due to low efficiencies resulting from lack of supplier competition.
4. Vertical integration reduces flexibility due to previous upstream or downstream investments.

5. Decreased ability to increase product variety if significant in house development is required.
6. It increases bureaucracy and its attendant costs.
7. It may lead to loss of specialisation.

Self-Assessment Exercise

1: Outline the benefits of Vertical Integration.
2.What is diversification?

1.4 Conclusion

In this unit, you have learnt that diversification and vertical integration are exante risk management techniques. Diversification is an effective way of reducing income variability while vertical integration, generally, decreases risk associated with the quantity and quality of inputs or outputs.

1.5 Summary

In this unit, topics covered are enterprise diversification and vertical integration as risk mitigation methods.

1.6 References/Further Reading/Web Sources

Bamiro, O. M. (2012). *Economics of Vertical Integration in the Poultry Industry*. KGSaarbrucken, Germany: LAP LAMBERT Academic Publishing GmbH & Co.

1.7 Possible Answers to Self-Assessment Exercises

1: Outline the benefits of Vertical Integration

i. Vertical integration reduces transportation costs and risk associated with transporting inputs and outputs if common ownership results in closer geographic proximity.
ii. It Improves supply chain coordination.
iii. Firms may integrate as a risk reduction strategy.
iv. Vertical integration as a risk management strategy minimises losses and costs thereby increases the profitability of business enterprises.
v. It provides more opportunities to differentiate by means of increased control over inputs.
vi. Entrepreneur and the farmers can guarantee the quality of inputs.
vii. It ensures adequate and timely supply of inputs.

2. Diversification is a frequently used extant risk management strategy that involves participating in more than one activity. Diversification is an effective way of reducing income variability. It is the combining of different production processes. Effective diversification occurs when low income from one enterprise is offset by satisfactory or high incomes from other enterprises. It typically reduces large year-to-year variations in income and may ensure adequate cash flow for meeting production costs, debt obligations, and family living needs. However, acquiring new overall knowledge about an alternative business, new crop production expertise, and new equipment for a new crop may be costly.

Unit 2 Hedging, Leasing and Off-Farm Employment as Risk Mitigation Methods

Unit Structure

2.1 Introduction

Hedging (future contract), off-farm employment and leasing are risk management techniques that farmers on their own employ to mitigate risk in their farms with the aim of reducing income output and income variability. A primary use of futures involves shifting risk from a firm that desires less risk (the hedger) to a party who is willing to accept the risk in exchange for an expected profit (the speculator). Off-farm employment or investment can provide a more certain income stream to the farm household to supplement income from the farming operation. Leasing is a method used to expand control over resources of another person with mutual agreement of rental payment.

2.2 Learning Outcomes

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

- explain the meaning of hedging and leasing
- state the advantages of leasing
- discuss the use of off-farm employment as a risk mitigation method.

2.3 Main Content

2.3.1 Hedging (Future Contract)

A future contract is an agreement priced and entered on an exchange to trade at a specified future time a commodity or other asset with specified attributes (or in the case of cash settlement, an equivalent amount of money). Futures contracts provide farmers (as well as processors, merchandisers, and others) with a method for reducing their risks. Futures contracts were almost exclusively traded on commodity prices in the past, although innovations in recent decades also have introduced contracts on interest rates, foreign exchange rates, price indexes, and crop yields. Futures contracts are also available on some inputs used by some farmers, especially livestock feeders. Futures contracts introduce additional flexibility into an individual farmer's marketing responses.

A primary use of futures involves shifting risk from a firm that desires less risk (the hedger) to a party who is willing to accept the risk in exchange for an expected profit (the speculator). Also, hedgers with opposite positions in the market trade with each other, and speculators with opposing views of the market may also trade. Most futures contracts are offset by opposite trades before delivery time, with each party to the transaction selling (or buying) a futures contract that was initially bought (or sold).

2.3.2 Off-Farm Employment

Earning off-farm income is another strategy that farmers may use to mitigate the effects of agricultural risk on farm family household income. Not only can off-farm income supplement household income, it may also provide a more reliable stream of income than farm returns. In essence, off-farm income can offer a form of diversification. The incentives for diversifying income sources depend on the level and variability of returns when considering a risk-averse producer. If farm households are risk averse, then they will be willing to supply relatively more labor to stable off-farm occupations than they would otherwise or, they may seek out other types of off-farm income (such as interest and dividends) to counter negative fluctuations in farm income.

2.3.3 Leasing Inputs and Hiring

Producers can also manage their farming risks by either leasing inputs (including land) or hiring workers during harvest or other peak months. Leasing refers to a capital transfer agreement that provides the renter (the actual operator) with control over assets owned by someone else for a given period, using a mutually agreed upon rental arrangement. Farmers

can lease land, machinery, equipment, or livestock. Leasing is a method used to expand control over resources. In addition, it commits the farmer to regular payments.

2.3.3.1 Advantages of leasing

Leasing appears, however, to have some advantages.

1. One advantage is that control can be gained over long-life inputs (such as land and machinery), without making long-term payment commitments.
2. Leasing provides producers with flexibility in allocating their asset portfolios—a producer can be in either the farming business or the land ownership business, without being in both.
3. Leasing has potential advantages to those who are renting. Leasing improves the renter's flexibility to respond to changing market conditions.
4. It reduces the long-term fixed payments on borrowed capital that may strain liquidity in years of reduced output.
5. It reduces both financial and production risk for the renter.
6. In essence, leasing limits fixed costs, providing greater flexibility for the renter to adapt.
7. It also offers a way to enter farming or to manage the size of the operation without requiring large investments of capital. One disadvantage, however, is that renting may limit the short-term borrowing capacity of an operation because of the absence of collateral to back a loan.
8. Advantages may further accrue from the perspective of the owner. Leasing allows the owner of the asset to receive a return on his or her investment, and may reduce risk when a share rental arrangement is used if the owner is confident of the renter's management ability. In the case of a cash lease, the owner's income risk is reduced substantially.

Self-Assessment Exercise

1: List the advantages of leasing.
2. What is hedging?

2.4 Conclusion

In this unit, you have learnt about hedging, off-farm employment and leasing as methods of risk mitigation. Hedging uses futures or options contracts to reduce the risk of adverse price changes prior to an anticipated cash sale or purchase of a commodity. Incomes from off-farm

employment are used to supplement farm incomes thereby reduce income variability. Hedging, off-farm employment and leasing are used to mitigate financial risk.

2.5 Summary

Three methods of mitigation, hedging, off-farm employment and leasing are covered in this study unit.

2.6 References/Further Reading/Web Sources

Bamiro, O. M. (2012). *Economics of Vertical Integration in the Poultry Industry*. KGSaarbrucken, Germany: LAP LAMBERT Academic Publishing GmbH & Co.

2.7 Possible Answers to Self-Assessment Exercises

1: List the advantages of leasing.

i. One advantage is that control can be gained over long-life inputs (such as land and machinery), without making long-term payment commitments.
ii. Leasing provides producers with flexibility in allocating their asset portfolios—a producer can be in either the farming business or the land ownership business, without being in both.
iii. Leasing has potential advantages to those who are renting. Leasing improves the renter's flexibility to respond to changing market conditions.
iv. It reduces the long-term fixed payments on borrowed capital that may strain liquidity in years of reduced output.
v. It reduces both financial and production risk for the renter.
vi. In essence, leasing limits fixed costs, providing greater flexibility for the renter to adapt.
vii. It also offers a way to enter farming or to manage the size of the operation without requiring large investments of capital. One disadvantage, however, is that renting may limit the short-term borrowing capacity of an operation because of the absence of collateral to back a loan.
viii. Advantages may further accrue from the perspective of the owner. Leasing allows the owner of the asset to receive a return on his or her investment, and may reduce risk when a share rental arrangement is used if the owner is confident of the renter's management ability. In the case of a cash lease, the owner's income risk is reduced substantially.

2. Hedging:

A future contract is an agreement priced and entered on an exchange to trade at a specified future time a commodity or other asset with specified attributes (or in the case of cash settlement, an equivalent amount of money). Futures contracts provide farmers (as well as processors, merchandisers, and others) with a method for reducing their risks. Futures contracts were almost exclusively traded on commodity prices in the past, although innovations in recent decades also have introduced contracts on interest rates, foreign exchange rates, price indexes, and crop yields. Futures contracts are also available on some inputs used by some farmers, especially livestock feeders. Futures contracts introduce additional flexibility into an individual farmer's marketing responses.

Unit 3 Management Alternatives, Information and Adoption of Technology as Risk Mitigation Methods

Unit Structure

3.1 Introduction

In addition to the risk mitigation methods considered earlier on, other risk mitigation methods that farmers employ are management alternatives, information and adoption of technology. Good management practices can be used to mitigate risk and sometimes prevent the risk occurrence.

3.2 Learning Outcomes

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

- explain management principles that can be used to mitigate specific agricultural risks
- state the importance of information in risk mitigation
- discuss the roles of technology in risk mitigation.

3.3 Main Content

3.3.1 Management Alternatives

There are numerous examples of how risk can be minimised or controlled through improved management practices.

(a) Application of Agrochemicals and fertilizer: Application of chemicals (such as herbicides and pesticides) and fertilizer (organic and inorganic) use is all about controlling (or reducing) the variability in production.
(b) Irrigation is very effective in minimising the effects of low rainfall or drought.

(c) Timeliness of operations has a very large impact on most production activities. Frequently, about the only difference between successful farmers and less successful farmers, who engage in the same production enterprises, is that the successful farmer is timelier in getting things done.

(d) Practicing preventative maintenance is typical of farmers who do a good job of managing production risks through minimising or controlling as best as possible the likelihood of negative events taking place. Practicing preventative maintenance and monitoring production activities more closely ensure problems are detected early enough to take corrective measures.

3.3.2 Information

Having good and up-to-date information can greatly reduce the risk associated with agricultural production. Agricultural companies, as well as universities, are constantly doing research to test and develop new and better ways of producing various agricultural commodities. A farmer who is well informed about and follows new and proven production practices can reduce his production risk. For example, a producer who knows and follows proper care and milking practices on a dairy enterprise can help avoid many diseases, significantly lowering the risk of production loss. Similarly, a crop farmer who becomes aware of a recently emerging crop disease can apply disease-resisting pesticides or plant disease resistant varieties may save his crop from devastation. In Nigeria, and other less developed countries, though the information of the new technology or innovations are available at the universities and research institutes but the farmers have no access due to lack of effective communication between the researchers and the end-users, the farmers. This problem is hinged on lack of enough extension workers. In Nigeria, for instance, the ratio of extension workers to farmers is ratio 1 to 4000.

3.3.3 Adoption of New Technology

Adopting new technologies can also help reduce production risk. There are countless opportunities to apply new technology in managing production risk on the farm. This includes the physical technology (high tech) often referred to as precision agriculture. Precision agriculture takes advantage of advances in computers and mechanical engineering to make better, more efficient, machines and equipment. For example, a crop producer who invests in new machinery or irrigation equipment may lower the risk of equipment or water problems reducing his yield.

Similarly, biotechnology and the focus of genetic research on improving yield have produced seed varieties that are more resistant to drought and disease and can reduce production risk for farmers. Scientists are

developing crop varieties that can withstand environmental stresses such as drought, flood, frost, or extreme temperatures. A related area of research is adapting crops to regions where they are not normally grown because of climate, altitude, or rainfall. Biotechnology is also being used against plant pests such as weeds, insects, and diseases.

Animal agriculture also is being affected by biotechnology. Safer and more effective vaccines are already in use. Biotechnology is being used to develop diagnostic tests for a wide range of diseases and viruses. The key to applying technology in managing risk is to do so in a way to lower total farm risk. Sometimes new technology may increase risk, or the increased cost for the corresponding reduction in risk is prohibitive.

Self-Assessment Exercise

1: Explain the numerous examples of how risk can be controlled through improved management practices.
2. What are the benefits of biotechnology?

3.4 Conclusion

Management practices such as fertilizer, pesticides application and irrigation are used to reduce the effect low soil fertility, pest attack and low rainfall respectively. Availability of relevant information at the appropriate time and adoption of technology are tools that farmers can use to mitigate risk.

3.5 Summary

In this unit, you have learnt about management alternatives, information and adoption of technology as risk mitigation methods

3.6 References/Further Reading/Web Sources

OECD. (2008). *An assessment of Risk Exposure in Agriculture: A Literature Review*. Part of the Trade and Agriculture Directorate Project on Risk Management in Agriculture.

OECD. (2009). *Risk Management in Agriculture: A Holistic Conceptual Framework*. Part of the Trade and Agriculture Directorate Project on Risk Management in Agriculture.

3.7 Possible Answers to Self-Assessment Exercises

1. Explain the numerous examples of how risk can be controlled through improved management practices.

(a) Application of Agrochemicals and fertilizer: Application of chemicals (such as herbicides and pesticides) and fertilizer (organic and inorganic) use is all about controlling (or reducing) the variability in production.

(b) Irrigation is very effective in minimising the effects of low rainfall or drought.

(c) Timeliness of operations has a very large impact on most production activities. Frequently, about the only difference between successful farmers and less successful farmers, who engage in the same production enterprises, is that the successful farmer is timelier in getting things done.

(d) Practicing preventative maintenance is typical of farmers who do a good job of managing production risks through minimising or controlling as best as possible the likelihood of negative events taking place. Practicing preventative maintenance and monitoring production activities more closely ensure problems are detected early enough to take corrective measures.

2. Animal agriculture also is being affected by biotechnology.

Safer and more effective vaccines are already in use. Biotechnology is being used to develop diagnostic tests for a wide range of diseases and viruses. The key to applying technology in managing risk is to do so in a way to lower total farm risk. Sometimes new technology may increase risk, or the increased cost for the corresponding reduction in risk is prohibitive.

Unit 4 Risk Transfer/Risk Sharing Strategies

Unit Structure

4.1 Introduction

Risk transfer refers to the transfer of the potential financial consequences of particular risks from one party to another. While insurance is the best-known form of risk transfer, in developing countries the use of informal risk transfer within families and communities is extremely important. Risk sharing involves a contract in which risk is shared. This risk sharing characteristic distinguishes this type of contract from other forms of contract. The risk sharing or transfer is based on the concept of pooling. The principle of pooling operates by combining independent losses in a pool, the expected total amount of losses stays the same, but the variance of individual losses decreases.

4.2 Learning Outcomes

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

- explain the meaning of risk transfer/risk sharing
- discuss the means of risk transfer.

4.3 Main Content

4.3.1 Risk Transfer or Risk Sharing

Risk sharing tools differ in the type of risk shared (e.g. price versus production risk), the party with whom the risk is shared (e.g. a colleague farmer versus a contractor), and whether the risk is shared directly or indirectly (e.g. production versus insurance contract). Major forms of risk transfer or risk sharing contracts include the following.

Contracting

A contract is usually defined as a written or oral agreement between two or more parties involving an enforceable commitment to do or refrain from doing something. In agriculture, contracts between farmers and agribusinesses specify certain conditions associated with producing and/or marketing an agricultural product. By combining various market functions, contracting generally reduces participants' exposure to risk. In addition to specifying certain quality requirements, contracts also can specify price, quantities to be produced, and services to be provided.

Farmers enter into contracts for various reasons, including income stability, improved efficiency, market security, and access to capital. Processors enter into contracts to control input supplies, improve responses to consumer demand, and expand and diversify operations. All of these reasons reflect efforts to bring a more uniform product to market. Risk transfer through contracts can be in the following forms.

Production contracts

Production contracts guarantee market access, improve efficiency, and ensure access to capital, and lower startup costs and income risk. Production contracts usually detail inputs to be supplied by the contractor, the quality and quantity of the commodity to be delivered, and compensation to be paid to the grower. The contractor typically provides and retains ownership of the commodity (usually livestock) and has considerable control over the production process.

On the downside, production contracting can limit the entrepreneurial capacity of growers, and contracts can be terminated on short notice. Production contracts can take many forms, depending upon the commodities being contracted and the economic needs of the parties entering into the contract. Generally, producers give up some management independence and decision making for a more stable income and less variability.

Marketing contracts

Marketing contracts set a price (or pricing mechanism), quality requirements, and delivery date for a commodity before harvest or before the commodity is ready to be marketed. The grower generally retains ownership of the commodity until delivery and makes management decisions. Farmers generally are advised to forward price less than 100 percent of their expected crop until yields are well assured to avoid a shortfall that would have to be made up by purchases in the open market.

Share tenancy
Share tenancy also called share cropping or share lease is a land lease under which the rent paid by the tenant is a contracted percentage of the value of output per unit of time. As a rule, the landowner provides land and the tenant provides the labour while other inputs may be provided by either party. Nowadays, in share tenancy is less widely used; it has often been replaced by the wage system on one hand and by full land rental contracts on the other.

Agricultural insurance
Agricultural insurance is a means by which farmers formally transfer risks to a an insurance company after paying a premium that will enable him to receive indemnity from the pooled resources in case the risk insured against occur. The insurer is the party that pools the risks, but risks are still shared among the insured. Agricultural insurance shall be discussed in detail in Module 6.

Self-Assessment Exercise

1: What do you understand by share tenancy?
2. What is the relevance of contract in agriculture?

4.4 Conclusion

Risk transfer refers to the transfer of the potential financial consequences of particular risks from one party to another. Risk can be transferred or pooled by contract, share tenancy and insurance.

4.5 Summary

In this unit, you have learnt about risk transfer/risk sharing. The means of risk transfer are production contract, marketing contract, share tenancy and agricultural insurance.

4.6 References/Further Reading/Web Sources

OECD. (2008). *An assessment of Risk Exposure in Agriculture: A Literature Review*. Part of the Trade and Agriculture Directorate Project on Risk Management in Agriculture.

OECD. (2009). *Risk Management in Agriculture: A Holistic Conceptual Framework*. Part of the Trade and Agriculture Directorate Project on Risk Management in Agriculture.

4.7 Possible Answers to Self-Assessment Exercises

1: What do you understand by share tenancy?

Share tenancy: *Share tenancy also called share cropping or share lease is a land lease under which the rent paid by the tenant is a contracted percentage of the value of output per unit of time. As a rule, the landowner provides land and the tenant provides the labour while other inputs may be provided by either party. Nowadays, in share tenancy is less widely used; it has often been replaced by the wage system on one hand and by full land rental contracts on the other.*

2. Contracting:

A contract is usually defined as a written or oral agreement between two or more parties involving an enforceable commitment to do or refrain from doing something. In agriculture, contracts between farmers and agribusinesses specify certain conditions associated with producing and/or marketing an agricultural product. By combining various market functions, contracting generally reduces participants' exposure to risk. In addition to specifying certain quality requirements, contracts also can specify price, quantities to be produced, and services to be provided.

Farmers enter into contracts for various reasons, including income stability, improved efficiency, market security, and access to capital. Processors enter into contracts to control input supplies, improve responses to consumer demand, and expand and diversify operations. All of these reasons reflect efforts to bring a more uniform product to market. Risk transfer through contracts can be in the following forms.

Unit 5 The Nigerian Incentive-Based Risk Sharing System For Agricultural Lending (NIRSAL)

Unit Structure

5.1 Introduction

The agricultural sector is central to Nigeria's economy, accounting for 40 percent of the Gross Domestic Product (GDP) and providing over 60 percent of employment. However, the sector represents only 1 percent of exports. Over the last decade, agricultural growth has slowed down and today it is under-performing despite enormous potentials. To reverse the trend, there will be need to tackle some of its major challenges such as low productivity, poor technology and cultural practices, low research and development, and under-financing of the agricultural value chain.

In particular, funding level in the agricultural sector stands at about 2 percent of the total lending of banks as against 6 percent in a country like Kenya. Some of the reasons for the low funding include lack of understanding of the agricultural sector, perceived high risks, complex credit assessment processes/procedure and high transaction costs. Addressing these issues require an innovative approach, hence the introduction of the Nigeria Incentive-Based Risk Management System for Agricultural Lending (NIRSAL).

5.2 Learning Outcomes

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

- state the goals of NIRSAL
- discuss the NIRSAL concept
- identify the NIRSAL crop pilots
- explain the benefits of NIRSAL initiatives to each stakeholder.

5.3 Main Content

5.3.1 The NIRSAL Concept

NIRSAL is a dynamic, holistic approach that tackles both the agricultural value chain and the agricultural financing value chain. **NIRSAL does two things at once- fixes the agricultural value chain**, so that banks can lend with confidence to the sector and, **encourages banks to lend to the agricultural value chain** by offering them strong incentives and technical assistance. NIRSAL emphasises lending to the **value chain and to all sizes of producers-** unlike previous schemes which encouraged banks to lend without clear strategy to the entire spectrum of the agricultural value chain.

There are five pillars to be addressed by an estimated USD 500 million of CBN money that will be invested as follows:

- **Risk-sharing Facility (USD 300 million**). This component would address banks' perception of high-risks in the sector by sharing losses on agricultural loans.
- **Insurance Facility (USD 30 million).** The facility's primary goal is to expand insurance products for agricultural lending from the current coverage to new products, such as weather index insurance, new variants of pest and disease insurance etc.
- **Technical Assistance Facility (USD 60 million).** This will equip banks to lend sustainably to agriculture, producers to borrow and use loans more effectively and increase output of better quality agricultural products.
- **Holistic Bank Rating Mechanism (USD 10 million).** This mechanism rates banks based on two factors, the effectiveness of their agricultural lending and the social impact and makes them available for the public.
- **Bank Incentives Mechanism (USD 100 million**). This mechanism offers winning banks in Pillar four, additional incentives to build their long-term capabilities to lend to agriculture. It will be in terms of cash awards.

5.3.2 Crop Value Chains as Pilots

In the first instance, six pilot crop value chains have been identified, based on existing crop production levels and potentials in six high potential bread basket areas. The crops are:

- Tomatoes
- Cotton
- Maize

- Soya beans
- Rice
- Cassava

5.3.3 NIRSAL Targets

Here, take note of the following.

(a) Generate an additional USD 3 billion of bank lending within 10 years to increase agricultural lending from the current 1.4 to 7 percent of total bank lending.
(b) Increase lending to the "pooled" small farmer segment to 50 percent of the total (typically, banks do not reach these producers individually but through "pools", i.e., aggregating mediators, such as MFIs and cooperatives).
(c) Reach 3.8 million agricultural producers by 2020 through pooling mechanisms such as value chains, MFIs, and cooperatives. (d) Reduce banks' break-even interest rate to borrowers from 14 to 7.5-10.5 percent.

Implementation
NIRSAL and its five pillars will be administered by a Non-Banking Financial Institution (NBFI.) At the national level, the NBFI will administer the five NIRSAL pillars. It will report to a Board of Directors chaired by the CBN and memberships from AGRA, the Ministries of Agriculture, Finance, and Commerce and Industry. The Board will have ultimate decision-making and strategy-setting responsibility for the Fund. The CEO of the NBFI will be responsible for NIRSAL's overall implementation and for maintaining relationships with key stakeholders. At the regional levels, Regional Transformation Engines will administer NIRSAL, through Portfolio Investment Managers and Technical Assistance Representatives.

5.3.4 Benefits of the NIRSAL Initiative

The benefits that will accrue from NIRSAL initiative is classified according to the reaping of the stakeholders. The benefits are presented below:

Central Bank of Nigeria
- Increased lending to agriculture from 1.4 to 7 percent of total bank lending within 10 years.
- Increased income, GDP, foreign exchange earnings and the implication on the Bank's ability to manage the value of local currency.

- Lower food inflation and maintain monetary robust external reserves as well as monetary stability.
- In addition, the project will absolve the Bank of the need for endless and voluminous subsidies to the agricultural sector.

Commercial Banks
- Opportunity for capturing latent profits in agricultural lending,
- maintain long term human, institutional and cultural capacity for value chain financing capacity and
- enjoy lower loan origination and distribution costs.

Agricultural Producers
- Increased access to credit,
- enhanced adoption of better cultural and agronomic practices,
- use of improved inputs like seeds and fertilizers,
- increased productivity and profit, income, standards of living and job creation and
- poverty reduction.

Ministry of Agriculture
- A stronger agricultural sector with six showcase value chains,
- enhanced food security,
- reduces imports, and
- higher productivity.

Ministry of Finance
- A stronger economy with additional agricultural GDP growth,
- higher employment,
- reduced expenditure on food imports,
- higher tax revenue from the agricultural sector, • competitive exports and a more diversified economy.

State Governments
- An improved agricultural economy at state level creating more employment,
- poverty reduction
- enhanced food security and
- higher tax revenue from a better-performing, well-financed sector.

Self-Assessment Exercise

1: Mention the NIRSAL targets.
2. NIRSAL does two things at once. Explain.

5.4 Conclusion

NIRSAL is a new initiative by which Nigerian government share agricultural credit risk with farmers by involving all stakeholders in the field of agriculture. NIRSAL does two things at once; fixes the agricultural value chain, so that banks can lend with confidence to the sector and, encourages banks to lend to the agricultural value chain by offering them strong incentives and technical assistance.

5.5 Summary

In this unit, we have considered the initiative of government on agricultural credit risk sharing. The initiative is referred to as Nigerian Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL). The concept of NIRSAL, implementation of the initiative, and the benefits to all stakeholders have been discussed in this unit.

5.6 References/Further Reading/Web Sources

Federal Ministry of Agriculture and Rural Development. (2011). 'The Nigerian Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL)'. Retrieved from www.fmard.gov.ng .

5.7 Possible Answers to Self-Assessment Exercises

1: Mention the NIRSAL targets.

(a) Generate an additional USD 3 billion of bank lending within 10 years to increase agricultural lending from the current 1.4 to 7 percent of total bank lending.

(b) Increase lending to the "pooled" small farmer segment to 50 percent of the total (typically, banks do not reach these producers individually but through "pools", i.e., aggregating mediators, such as MFIs and cooperatives).

(c) Reach 3.8 million agricultural producers by 2020 through pooling mechanisms such as value chains, MFIs, and cooperatives. (d) Reduce banks' break-even interest rate to borrowers from 14 to 7.5-10.5 percent.

2. NIRSAL does two things at once:

- fixes the agricultural value chain, so that banks can lend with confidence to the sector and, encourages banks to lend to the agricultural value chain by offering them strong incentives and technical assistance. NIRSAL emphasises lending to the value chain and to all sizes of producers- unlike previous schemes which encouraged banks to lend without clear strategy to the entire spectrum of the agricultural value chain.

Unit 6 Risk Coping Strategy

Unit Structure

6.1 Introduction

After risk mitigation and transfer strategies have been assessed and implemented, the next step is to accept the remaining risk(s) and take measures to cope with them. Risk coping involves strategies that are employed to confront and cushion the effect or consequences of risks in agriculture and other agribusiness enterprises. Such strategies are categorised as ex-post strategies.

6.2 Learning Outcomes

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

- explain the meaning of risk coping strategy
- state and discuss the means of coping with specific risks in agriculture.

6.3 Main Content

6.3.1 Liquidity

A risk coping strategy by which farmers manage financial risk is liquidity. It involves the farmer's ability to generate cash quickly and efficiently in order to meet his or her financial obligations. The liquidity issue relates to cash flow and addresses the question: "When adverse events occur, does a farmer have assets (or other monetary sources) that can easily be converted to cash to meet his or her financial demands?"

Asset liquidity depends on the relationship between the firm's assets and the expected cash proceeds from the sale of each of those assets. An asset

is perfectly liquid if its sale generates cash equal to, or greater than, the reduction in the value of the firm due to the sale. Illiquid assets, in contrast, cannot be quickly sold without a producer's accepting a discount, reducing the value accruing to the firm by more than the expected sale price. Examples of liquid assets include grain in storage, cash, and company stock holdings, while illiquid assets include land, machinery, and other fixed assets. Factors that influence liquidity include marketability of the asset, the length of time allowed for liquidation before the cash is needed, transactions costs, and the asset's income generating role in the firm. Liquidity management is interrelated with risk responses in production and marketing, and also with the farm's degree of leverage. The more highly leveraged the farm, everything else being equal, the greater the need for careful liquidity management in order to make timely payments on loans and other farm financial obligations.

Some of the methods that farmers use to manage liquidity, and hence their financial risk, include the following:

(a) Selling Asset

A producer's willingness to sell assets is an important financial response to risk, particularly in crisis situations (Barry and Baker). If a farmer faces a low net income in a given year, selling liquid assets (such as stored grain or nonfarm assets, such as stocks) is a first step in meeting expenses for the year. Holding liquid assets, however, may be costly because they typically earn lower returns than when used in the production process (assuming the economic viability of the operation). If the use of liquid assets is not adequate to meet financial demands, additional steps—such as the sale of less liquid assets—may be necessary. Due to the fact that many farmers invest heavily in illiquid assets, such as land, livestock, and machinery, maintaining liquidity to meet shortfalls in returns may, at times, be difficult.

(b) Managing the Pacing of Investments and Withdrawals

Maintaining flexibility in the timing of farm investments and withdrawals is also a response to financial risk. In low income periods, for example, a producer may postpone the purchase of new machines and other equipment. This is an approach favored by many producers during times of adversity. It avoids large financial outlays during such periods, builds equity, reduces indebtedness, and allows the strengthening of profitability in a rapidly expanding farm operation (Barry and Baker). The more highly leveraged the farm, the greater the need for careful liquidity management in order to make timely payments on loans and other obligations.

6.3.2 Household Off-Farm Employment

Off–farm employment is a risk coping strategy. It provides a stream of income to the farm operator household that is more reliable and steadier than returns from farming. In essence, household members working off the farm is a form of diversification.

6.3.3 Borrowing

Borrowing is another risk coping strategy that is most widely used by farmers in response to agricultural risks, especially financial risks. Borrowing could be from formal and informal sources. Repeated borrowing, however, could lead to selling agricultural land which is a very high-risk alternative. Loan acquisition, especially from informal sources, always eats up into the profits that will eventually accrue to the farmers due to high rate of interest. With respect to formal sources, bureaucracy and demand for collateral- in form of land and buildings attached to loan procurement often result into emergence of another risk.

6.3.4 Disaster Relief Grant

The consequences of certain risks in agricultural production could be so disastrous and financially enormous that it will require the assistance of governments at all levels. Government and non-governmental organisation do respond to the clarion call of farmers by giving disaster relief grant. This was the experience of poultry farmers in Nigeria in 2012 when there was an outbreak of avian flu that claimed several thousands of birds.

Self-Assessment Exercise

1: Explain the methods that farmers use to manage liquidity.
2. Examine the concept of asset liquidity.

6.4 Conclusion

Risk coping involves strategies that are employed to confront and cushion the effect or consequences of risks in agriculture. There are different means of coping with agricultural risks.

6.5 Summary

In this unit, you have learnt about risk coping strategies. Risk coping strategies include liquidity, off-farm employment, borrowing and disaster relief grant.

6.6 References/Further Reading/Web Sources

Government of India Planning Commission. *Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012.)* New Delhi.

6.7 Possible Answers to Self-Assessment Exercises

1: Explain the methods that farmers use to manage liquidity.

(a) Selling Asset

A producer's willingness to sell assets is an important financial response to risk, particularly in crisis situations (Barry and Baker). If a farmer faces a low net income in a given year, selling liquid assets (such as stored grain or nonfarm assets, such as stocks) is a first step in meeting expenses for the year. Holding liquid assets, however, may be costly because they typically earn lower returns than when used in the production process (assuming the economic viability of the operation). If the use of liquid assets is not adequate to meet financial demands, additional steps—such as the sale of less liquid assets—may be necessary. Due to the fact that many farmers invest heavily in illiquid assets, such as land, livestock, and machinery, maintaining liquidity to meet shortfalls in returns may, at times, be difficult.

(b) Managing the Pacing of Investments and Withdrawals

Maintaining flexibility in the timing of farm investments and withdrawals is also a response to financial risk. In low income periods, for example, a producer may postpone the purchase of new machines and other equipment. This is an approach favored by many producers during times of adversity. It avoids large financial outlays during such periods, builds equity, reduces indebtedness, and allows the strengthening of profitability in a rapidly expanding farm operation (Barry and Baker). The more highly leveraged the farm, the greater the need for careful liquidity management in order to make timely payments on loans and other obligations.

2. **Asset liquidity** depends on the relationship between the firm's assets and the expected cash proceeds from the sale of each of those assets. An asset is perfectly liquid if its sale generates cash equal to, or greater than, the reduction in the value of the firm due to the sale. Illiquid assets, in contrast, cannot be quickly sold without a producer's accepting a discount, reducing the value accruing to the firm by more than the expected sale price. Examples of liquid assets include grain in storage, cash, and company stock holdings, while illiquid assets include land, machinery, and other fixed assets. Factors that influence liquidity include marketability of the asset, the length of time allowed for

liquidation before the cash is needed, transactions costs, and the asset's income generating role in the firm. Liquidity management is interrelated with risk responses in production and marketing, and also with the farm's degree of leverage.

Module 5 Agricultural Insurance

Unit 1 Meaning And Scope Of Agricultural Insurance

Unit Structure

1.1 Introduction

The farmer is the agent that is best positioned to know the dimension, characteristics and correlations of the risks that affect his farm. He is also the best positioned to evaluate the availability of different strategies to deal with this risk. It is the farmer's responsibility as manager of his own farming business to take the appropriate decisions to manage the risk associated with his economic activity- farming. The generic strategies to reduce risk are risk sharing, risk pooling and diversification. Insurance is one major way of pooling risk together with the aim of reducing the impact of risk when they occur.

1.2 Intended Learning Outcomes

At the end of this unit, you should be able to:
Explain the meaning of agricultural insurance. Differentiate between self-insurance and commercial insurance. State the merits and demerits of self-insurance.

1.3 Meaning and Scope of Insurance

There are myriads of insurance definitions, few of them are considered in this section to give a solid background on the topic of discussion.

What is Insurance?
In general, insurance is a form of risk management used to hedge against a contingent loss. The conventional definition is the equitable transfer of a risk of loss from one entity to another in exchange for a premium or a guaranteed and quantifiable small loss to prevent a large and possibly devastating loss. Insurance is the means of protecting against unexpected loss. It is a financial response to risk which provides a specialised source of liquidity.

Insurance is defined as the elimination of the uncertain risk of loss for the individual through the combination of a large number of similarly exposed individual who can contribute to a common fund, premium payment sufficient to make good the loss caused by anyone individual. Insurance is also defined as a social device providing financial compensation for the effects of misfortune, the payment being made from the accumulated contributions of all parties particularly in the scheme Insurance involves the substitution of a small known cost for the possibility of a large but uncertain loss. It is a provision made for the protection of persons or property against risk and uncertainty. Agricultural insurance is an agreement in which a farmer pays to an insurance company premium for the company to help and indemnify the cost of losses, accident, injury and unpredicted environmental factors that are likely to affect crop and livestock output wherever they occur. Insurance is a contract which the insurer agree to pay a premium to the insurer and the insurer agrees to indemnify the insured against loss resulting to him or her on the happening of certain events or to pay a certain sum of money on the occurrence of a specified event. As a contract, the insurer promises to indemnify (compensate) the insured against loss that he may suffer in future, upon the payment of a premium.

Types of Insurance
Broadly speaking, there are two types of insurance namely, self-insurance and commercial insurance. Everyone has insurance; either you buy insurance from an insurance company, or you insure yourself. When you self-insure there are no premiums to pay, but in the event of a loss you pay the full amount. In other words, with self-insurance you have a policy with a 100 percent deductible.

Self-Insurance

Self-insurance is a type of insurance in which an individual or organisation refuse to buy insurance from an insurance company with readiness to bear the consequences of risks that may occur in the business enterprise. Self- insurance involves maintaining a reserve of funds to offset a loss.

Merits of Self-Insurance

The merits of self- insurance are:

i There will be savings in risk management expenditure;
ii There will also be some savings from the cost of taking insurance policy;
iii There would be no payment of premium on the assets of the organisation;
iv Industry's claims experience does not increase organisation's cost of risk transfer;
v There will be direct incentive to reduce and control the risk of loss;
vi There will be no disputes arising as no contact exists between an insurer and insured in the event of loss;
vii Funds would be available for engaging qualified personnel for the insurance department.

Demerits of Self-Insurance

In corollary, there are some demerits in self-insurance. Such demerits are as follows:

i A catastrophic loss without insurance policy could lead to the liquidation of an organisation.
ii An aggregate of losses could have the same effect as a catastrophic loss.
iii It could lead to tying down investable funds for purpose of risk financing.
iv Self- insurance leads to incurring extra cost on the employment of staff for the insurance unit.
v Lack of access to technical advice from insurance company on risk management and control.
vi Contribution to the risk financing funds may not be exempted for tax purposes.

Commercial Insurance

Commercial insurance involves buying insurance from insurance company by an individual or an organisation in an exchange for a premium. Self-insurance and commercial insurance both involve costs for risk protection. The idea of insurance is to buy protection against a loss. Expenses associated with providing commercial insurance may vary from 10 to 50 percent or more of the premium. The premium paid by most

individuals will far exceed the amount they receive back from the insurance company. A type of commercial insurance, Agricultural insurance is our focus in the next subsection.

1.3.1 Meaning of Agricultural Insurance

Agricultural insurance is a financial tool to transfer risks associated with farming to a third party via payment of a premium that reflects the true long term cost to the insurer assuming those risks. Agricultural insurance is a special line of property insurance applied to agricultural firms. In recognition of the specialised nature of this type of insurance, insurance companies operating in the market either have dedicated agribusiness units or outsource the underwriting to agencies that specialise in it.

Agricultural insurance is defined in the Nigerian Agricultural Insurance Scheme (NAIS) operation guideline (1989) as the stabilisation of income, employment, prices and supplies of agricultural products by means of regular and deliberate savings and accumulation of funds in small installment by many farmers in favorable time periods, to defend some or a few of the participants in bad time periods.

According to Akubuilo, Umeabali, Mgbada, Ugwu, Egwu and Awoke (2007), agricultural insurance gives farmers a minimum protection against the risk of crop or livestock failure in return for the payment of a stipulated premium. In the event of losses, the insured farmer claims indemnity as a matter of right and eventually the losses are wholly or partly shared by the insured farmers themselves. Such contractual right to assist further enables farmers to improve their credit worthiness and stabilizes their income. This is a source of confidence to farmers as they venture into the adoption of innovation. It removes the fear of using credit facilities by guaranteeing a protection against loan repayment. The National Insurance Corporation of Nigeria (NICON) and Nigerian Agricultural Insurance Corporation (NAIC) operate an agricultural insurance scheme for the benefit of farmers as described in the subsequent units. The scheme provides financial relief to insured farmers who suffer losses arising from insured risks and uncertainties. The insurance company is a financial institution involved in the protection of persons and property against risks.

In Nigeria, insurance existed in a rudimentary form prior to the introduction of modern insurance business through associations, clubs and societies whose members make regular contributions in order to receive assistance in the event of any misfortune or death. These informal insurance organisations still exist due to some difficulties associated with modern insurance such as unnecessary delay or outright refusal to

compensate the insured; ignorance and the existence of social life (Aneke, 1998).

Insurance is regarded as a pool of risk because a large number of people who may likely suffer the same loss insure their property by contributing fund to a central pool supervised and administered by the insurance company. This small annual contribution is usually calculated in such a way that will be sufficient to indemnify those who actually suffer the insured loss as well as profiteer the insurance company. It is not all the insured that suffer loss arising from the insured risk at the same time. This ensures that the insured is properly compensated whenever he encounters any risk insured against. By so doing, the fortunate encourage the unfortunate who suffer losses (Esheya, 2011).

However, some risks are insurable while others are not. Insurable risks occur regularly and the insurance company calculates with some degree, the likelihood and predict on the basis of past statistics. Conversely, calculations and predictions cannot be made of non-insurable risks due to dearth of statistical data. Examples of non-insurance risks include risk arising from war, risks incapable of measurement (unforeseen changes in fashion, marketing of new products), risks that are too small and re-occur too frequently (breakages of crockery or cooking utensils), very large and infrequent risks (risk of modern nuclear warfare).

Thus, it may be seen as a kind of fund, into which all those insured will pay an assessed contribution (called premium), in return, those insured will have right to call on the fund for any appropriate payment should the insured event occur. The needs for agricultural insurance arose because the sector is exposed to varieties of risk and uncertainties.

There are several features of this type of insurance that validate it being treated as a special line business. Difficulties in achieving adequate diversification because of the nature of the risk, asymmetries of information in underwriting, the geographical dispersion of agricultural production and the complexity of the biological processes of production, which requires skilled and expert underwriting, justify it being considered a special business line.

1.3.2 Scope of Agricultural Insurance

Basically, agricultural insurance is designed to provide covers for financial losses incurred due to reduction in expected outputs from agricultural products. The major products are crops and livestock. Others include fisheries and forestry. Crop insurance and livestock insurance provide the two broad categories for which commercial insurance covers are designed. Because of the complexities brought to agricultural ventures

due to mechanisation, a broad range of traditional policies, namely personal accident, fire, vehicles, machinery and public liability covers are made essential parts of a comprehensive agricultural insurance package.

Agricultural investments, unfortunately, are among the most risky economic ventures one can embark upon. The absolute dependence on unpredictable weather conditions, like hailstorm, flood, drought and other natural hazards make income from crop production to be very unstable. Other agricultural products like livestock, poultry and dairies are exposed to the risks which occur in catastrophic proportions. The recent cases of bird flu and pig swine in Nigeria comes readily to mind. Agricultural insurance policies protect the farmer against these unforeseen circumstances by way of indemnification, it also serves as securities for banks for financial losses suffered by farmers from damages to their products and will provide funds for servicing loans. The capacity of the agricultural sector, to hedge itself from the vagaries and aberrations of nature, is considered critical to its development and growth. Many factors, including disasters, can slow the development process, by reducing domestic food supplies and raw materials in the short term. Natural disasters such as drought, floods and cyclones are a major source of risk in agriculture. A large cropped expanse of land is vulnerable to drought, in different degrees. Globally on an average, crops on million hectares of land are damaged annually, by natural calamities and adverse seasonal conditions in the country, grossly impacting the level of agricultural productivity and production. The insurance need for agriculture cannot be over emphasised, as it is a highly risky economic activity, on account of its critical dependence on weather conditions.

Most farmers use various forms of insurance to protect against specific types of losses. Fire insurance provides liquidity to replace losses due to fire. Most farmers find that commercial fire insurance is more cost effective than self- insurance (maintaining a reserve of funds to offset a loss). Risks which have a low probability of occurrence and very adverse consequences are the most logical risks to insure against. Liability, major medical, disability, and fire/extended coverage on buildings, equipment, and livestock are examples of insurance which many farmers carry. Self -insurance, included in the normal cost of doing business, is generally more cost effective for risks which occur frequently and cause only minor problems. Insurance to protect against hog deaths in finishing could probably be obtained, but farmers typically average out these losses as part of normal production costs.

Many other types of insurance with different levels of coverage are available. One's financial position is important in determining whether to self -insure or buy commercial insurance. A farmer in a strong financial position using the car only to drive to church might logically decide not

to carry collision insurance, even with a very high deductible. In contrast, another farmer in a weaker financial position whose spouse drives to work every day may logically carry collision insurance with the minimum deductible. The nature of agricultural production and agricultural products has made the design and implementation of an appropriate insurance program for agriculture, a very complex and challenging task.

1.3.3 Benefits of Agricultural Insurance

Overall benefits of agricultural insurance are outlined below.

(i) Cushions the shock of disastrous crop and livestock loss, by assuring farmers a minimum protection.
(ii) Crop and livestock Insurance spreads the losses over space and time. As agricultural income is an important factor in national income, crop insurance also has an effect on the prosperity of the country.
(iii) It gives farmers greater confidence, in making greater investments in agriculture.
(iii) It improves the position of farmers in relation to agricultural credit.
(iv) Government is relieved of present uncertain financial burden of providing relief.
(v) It can help normalise the availability of supplies and stabilise prices.
(vi) It will help maintain the dignity of farmers.
(vii) It enables maintenance of systematic records of crop and livestock production.

Self-Assessment Exercise

1: Mention the benefits of agricultural insurance.
2. Insurance involves the substitution of a small known cost for the possibility of a large but uncertain loss. Discuss.

1.4 Summary

In this unit, we have considered the meaning of insurance, self and commercial insurance; meaning, scope and benefits of agricultural insurance.

1.5 References/Further Reading/Web Sources

Akubuilo, C.J.C., Umeabali, E.E., Mgbada, J.U., Ugwu, D.S., Egwu, W.E. and Awoke, M.U. (2007). Readings in Agricultural Economics and Extension. Enugu: Computer Edge Publishers.

Aneke, J.I. (1998). Principles and Practice of Insurance. Lagos: Johnkens and Willey.

Esheya, S.E. (2011). Rudiments of Agribusiness Finance Management for Tertiary Institutions. Abakaliki: Legro Press.

Government of India Planning Commission. *Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012.)* New Delhi.

1.6 Possible Answers to Self-Assessment Exercises

1: Mention the benefits of agricultural insurance.

i. Cushions the shock of disastrous crop and livestock loss, by assuring farmers a minimum protection.
ii. Crop and livestock Insurance spreads the losses over space and time. As agricultural income is an important factor in national income, crop insurance also has an effect on the prosperity of the country.
iii. It gives farmers greater confidence, in making greater investments in agriculture.
iv. It improves the position of farmers in relation to agricultural credit.
v. Government is relieved of present uncertain financial burden of providing relief.
vi. It can help normalise the availability of supplies and stabilise prices.
vii. It will help maintain the dignity of farmers.
viii. It enables maintenance of systematic records of crop and livestock production.

2. It is a provision made for the protection of persons or property against risk and uncertainty. Agricultural insurance is an agreement in which a farmer pays to an insurance company premium for the company to help and indemnify the cost of losses, accident, injury and unpredicted environmental factors that are likely to affect crop and livestock output wherever they occur. Insurance is a contract which the insurer agree to pay a premium to the insurer and the insurer agrees to indemnify the insured against loss resulting to him or her on the happening of certain events or to pay a certain sum of money on the occurrence of a specified event. As a contract, the insurer promises to indemnify (compensate) the insured against loss that he may suffer in future, upon the payment of a premium.

Unit 2 Types of Agricultural Insurance and Insurability of Agricultural Risks

Unit Structure

2.1 Introduction

Earlier on, you learnt that agricultural insurance is a financial tool to transfer risks associated with farming to a third party via payment of a premium that reflects the true long-term cost to the insurer assuming those risks. Agricultural insurance is a special line of property insurance applied to agricultural firms. So, in this unit, you will learn more about agricultural risks and insurance.

2.2 Intended Intended Learning Outcomes

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

- state types of agricultural insurance
- explain the insurability of agricultural risk
- discuss crop and livestock insurance as risk management tools.

2.3 Main Content

2.3.1 Insurability of Risks

It is not all risks that are insurable. To be insurable, a risk must satisfy the following main criteria:

(i) The probability of a loss in the future, should lend itself to estimation. This is possible only if reliable data of losses is available for a sufficiently long period in the past.

(ii) The loss must be capable of being estimated in financial terms. (iii) The probability of occurrence needs to be in a medium range: if it is too high the premium will not be affordable; if it is too low, it

will not be possible to use the record of occurrences to estimate the likely distribution as accurately as possible.

(iv) Occurrence of an event, or the damage it causes, should not be affected by the insured's behavior (Moral Hazard).

(v) To the extent possible, the risk should be an Independent Risk.

(vi) The risk must be of fortuitous character.

(vii) It should be measurable in large number.

(viii) The cost of insurance or premium should be within the means of the average farmer.

In line with condition for insurability of risk, the probability of occurrence of death, fire losses, accident are measurable, and hence, insurable only because the number of observation is sufficiently large and is independently randomly distributed. Furthermore, risk and uncertainty that resulted from natural hazard result in losses of not only on the field but also, during storage, packaging and marketing of agricultural commodities. Pests, diseases and parasitic attacks are also hazards that occur most frequently on the farm annually and they cause a very high percentage of both field and post-harvest losses of agricultural products. Pilferage is a social risk that farmers have to contend with in the farm at different stages of crop and livestock production; hence, if the pilferage is substantial, and the losses can be estimated in financial term, then it is insurable risk.

2.3.2 Types of Agricultural Insurance

There are different types of agricultural insurance in countries where agricultural insurance has developed. The three types of insurance that all farmers should undertake are: 1) property and casualty insurance, 2) health, life, and disability insurance, and 3) liability insurance. Crop insurance is a very important type of property insurance that can be used very effectively in conjunction with marketing plans to reduce marketing risk. Crop insurance can guarantee a level of production, thus removing the risk associated with forward pricing or selling crops that are yet to be produced.

Crop insurance will provide the tons of the product to deliver on a contract should the insured producer suffer a loss prior to harvest. Medical expenses due to a serious illness or injury can wreak economic havoc on a family. Farmers are more likely to be disabled than killed in accidents and a good disability policy is as important as life insurance and is a good risk management tool. A liability policy protects a farmer against claims or lawsuits brought by persons whose property or person has allegedly been injured by the farmer's negligence.

2.3.3 Crop Insurance as a Risk Management Tool

Crop insurance is a mechanism to protect farmers, against the uncertainties of crop production, due to natural factors, beyond farmer's control. It is also a financial mechanism, which minimises the uncertainty of loss in crop production, by pooling most uncertainties that impact crop yields, so that the burden of loss can be distributed. Crop production involves numerous risks - natural, social, economic and personal. However, the principal characteristic, which distinguishes crop production from any other activity, is its great dependence on nature. Crop production unlike almost any other activity, has to be carried on in the face of continual uncertainties arising out of diverse natural and social elements.

Normally, the greatest impact of all these elements falls on crops, which remain under the open skies for weeks and months. Uncertainty of crop yield is thus one of the basic risks, which every farmer has to face, more or less, in all countries, whether developed, or developing. These risks are particularly high, in developing countries particularly in the tropics as in most of these countries; the overwhelming majority of farmers are poor, with extremely limited means and resources. They cannot bear the risks of crop failure of a disastrous nature. It is true that much of the present uncertainty of crop production in developing countries like Nigeria could be removed by technical measures and by improvements in the social and institutional set-up. The need for complete set of initiatives in this regard cannot be over-emphasised.

Still, a good deal of uncertainty will always be there, as no imaginable measure could make crop production completely independent of natural factors. Also, the physical measures envisioned, need to be justified by their cost-benefit ratio. There may be many places, for example, where flood is preventable, but the cost of prevention measures, would be far out of proportion to their benefit. In such cases, it would be bad economics to spend more capital in preventing a risk, than would be lost by the risk itself (especially where capital is so scarce). Secondly, with a growing population constantly pressing against land, no part of it could be given up for cultivation, simply because it is subject to periodical risks of failure. It is, as much in the country's interest, as in that of the individual owners that such lands should be kept under plough, even if there were occasional risks of failure.

Therefore, the risks of crop production have to be faced. However, a serious crop failure has a cascading effect leading to serious repercussions, for the entire community. Calamities relief by the government is a privilege and not a right; hence farmers cannot expect them always. Besides Nigerian government response to risks in the farm

often comes when the calamity affects a very large number of farmers. An important measure that is largely free from the above difficulties is crop insurance against all natural and unavoidable hazards.

2.3.4 Livestock Insurance as a Risk Management Tool

Livestock insurance is defined as a contract by which the insurer agrees to indemnify the insured against such loss sustained by reason of injury or the death of livestock by the happening of the perils specified or a contract to pay a certain sum of money on the death of an animal from disease or accident. Livestock industry is subject to outbreak of pests and diseases which often results in great losses to farmers. A recent experience of poultry farmers in Nigeria with the outbreak of avian flu led to loss of a large number of birds vis-a-vis financial losses. Disaster relief was granted to the poultry farmers to the tune of 631million naira.

Sometimes risks may be farm or local specific and not a national issue; such might not attract disaster relief. To combat such risks, farmers need livestock insurance to be protected. Livestock insurance helps farmers who lost their animals to severe drought conditions and outbreak of pests and diseases as they often do, to receive monetary compensation to either allow them to restock faster, invest in other productive activities or even purchase food and other items of necessity. Livestock insurance protects pastoralists against the full impact of drought-related losses. Insurance programme encourages productivity and returns from livestock-based livelihoods.

Self-Assessment Exercise

1: To be insurable, a risk must satisfy certain main criteria. Explain.
2. The three types of insurance that all farmers should undertake are…?

2.4 Conclusion

In this unit, you have understood the basis for which agricultural risks can be insured, types of agricultural insurance and how each is used as a tool in risk management.

2.5 Summary

In this unit, types of agricultural insurance, and insurability of agricultural risks are the objects of discussion.

2.6 References/Further Reading/Web Sources

Government of India Planning Commission. *Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012.)* New Delhi.

2.7 Possible Answers to Self-Assessment Exercises

1: To be insurable, a risk must satisfy certain main criteria. Explain.

i. The probability of a loss in the future, should lend itself to estimation. This is possible only if reliable data of losses is available for a sufficiently long period in the past.
ii. The loss must be capable of being estimated in financial terms. (iii) The probability of occurrence needs to be in a medium range: if it is too high the premium will not be affordable; if it is too low, it will not be possible to use the record of occurrences to estimate the likely distribution as accurately as possible.
iii. Occurrence of an event, or the damage it causes, should not be affected by the insured's behavior (Moral Hazard).
iv. To the extent possible, the risk should be an Independent Risk.
v. The risk must be of fortuitous character.
vi. It should be measurable in large number.
vii. The cost of insurance or premium should be within the means of the average farmer.

In line with condition for insurability of risk, the probability of occurrence of death, fire losses, accident are measurable, and hence, insurable only because the number of observations is sufficiently large and is independently randomly distributed. Furthermore, risk and uncertainty that resulted from natural hazard result in losses of not only on the field but also, during storage, packaging and marketing of agricultural commodities. Pests, diseases and parasitic attacks are also hazards that occur most frequently on the farm annually and they cause a very high percentage of both field and post-harvest losses of agricultural products. Pilferage is a social risk that farmers have to contend with in the farm at different stages of crop and livestock production; hence, if the pilferage is substantial, and the losses can be estimated in financial term, then it is insurable risk.

2. The three types of insurance that all farmers should undertake are:

a. property and casualty insurance,
b. health, life, and disability insurance, and,
c. liability insurance.

Unit 3 Agricultural Insurance in Nigeria

Unit Structure

3.1 Introduction

Insurance an effective mechanism of transferring large risks to someone else has been in use in developed countries more than one hundred years ago. Commercial agricultural finance came into being 26 years ago, an indication that Nigeria is indeed is a developing nation even in agricultural production, which has been the main economic backbone of the nation before the discovery of oil in late 60s.

3.2 Intended Intended Learning Outcomes

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

- discuss the evolution and principles of agricultural insurance in Nigeria
- state the objectives of Nigerian Agricultural Insurance Corporation (NAIC)
- identify the perils that are covered by NAIC
- explain the problems of Nigeria Agricultural Insurance Scheme.

3.3 Main Content

3.3.1 Evolution of Agricultural Insurance in Nigeria

Agricultural insurance as an alternative for risk management actually started as crop hail insurance in Europe, more than 100years ago, and it spread to the United State at the beginning of the century. It has since been embraced by a lot of developed and developing countries of the World, viz- USA, Canada, Japan, Mexico, Brazil, Bolivia, Coast Rica, Panama, Mauritius, India, Australia, Iran, Sri Lanka, Zambia, Philippine, Israel, Chile, Jamaica, Egypt, Cyprus, Sweden, Bangladesh and Venezuela-with varying degrees of successes and failures.

In Nigeria, commercial agricultural insurance scheme was pioneered by Niger insurance in May, 1987. National Insurance Corporation of Nigeria (NICON) fully owned by the Federal Government and the National Cooperative Insurance Society of Nigeria (NCISN) were also known to have operated insurance schemes with agricultural implication on a limited commercial scale. Similarly, some banks such as the United Bank for Africa (UBA) and Union Bank of Nigeria which were actively involved in giving credit facilities to the agricultural sector had to raise the sum assured of life assurance of loan applicants to qualify as suitable collateral for providing loan. Agricultural insurance scheme (NAIS), which was formerly launched on the 15th of December, 1987, was later followed by the incorporation of the Nigeria Agricultural Insurance Company (NAIC) in 1988 to implement the scheme.

3.3.2 Principles of Agricultural Insurance in Nigeria

Basic principles underlying agricultural insurance include:

i. **Proximate Cause-** This principle implies that before compensation can be paid, it must first of all be proved that the loss suffered was approximately caused by the event insured against. Thus, if a farmer insures his crop against fire but encountered flood, the insurance company will not entertain a claim under the policy.

ii. **Subrogation-** This refers to the right an insured has to acquire the insured's rights as well as his remedies against third parties. It is a situation where an insured has been fully compensated by the insurer but where alternative possibilities for compensation remain, by using a third party who is considered to have caused the loss. The insurer should take over the right to pursue this; otherwise, the insured could breach the indemnity principle. For instance, if an insurance company indemnifies a farmer for his tractor damaged in an auto-crash, he can neither sell the scrap nor claim some money from the third party whose negligence must

have caused the accident. It is the right of the insurance company to receive the scrap value of the tractor, sue or even collect money from the third party in agreement with the indemnity principle.

iii. **Utmost Good Faith-**Insurance is a contract of 'unberrimae fidei'. This implies that both the insurer and he insured must disclose all material facts regarding the subject matter of insurance. There must not be an attempt of any kind by any of the parties to deceive each other. Facts must be disclosed honestly and accepted prudently by the insured and insurer respectively.

iv. **Indemnity-** Excepting life assurance, the object of insurance is to restore the insured to the position he was in before the insured event occurred by aiming at putting him in the same position after the loss as he was before the loss. It should not be possible to gain a profit from the payment of insurance claim. Indemnity principle is a protection against loss, but only the loss and no more.

v. **Insurable Interest-** The insured only enters into a valid contract if he does actually stand a chance to suffer a financial loss or liability on the occurrence the event insured against. Thus, one neither insures the property of others nor their lives. However, ownership of the property to be insured is one of the recognized relationships in insurance. A mortgage may insure a property mortgaged to him; an employer may insure the life of his judge; husband and wife may insure one another; a creditor may insure the life of his debtor as the case may be. Each has an insurable interest in the life of the other depending on the existing relationship.

vi. **Consequential Loss-** Compensation cannot be claimed for a loss that is designated a consequential loss unless it is clearly provided for in the contract. Losses insured as a result of the intentional action of the insured is called a consequential loss.

3.3.3 History of Nigerian Agricultural Insurance Corporation (NAIC)

Prior to the establishment of NAIC, Nigerian farmers suffered various losses on their investment and had no means of going back to production. The frustration made them to move into cities in droves in search of easy means of livelihood. This situation led to depletion of farming populace, which was a serious threat to food security. The Federal Government was disturbed by the ugly trend, hence the establishment of NAIC to address the need of farmers. The need for a specialised Agricultural Insurance Company to provide insurance cover to farmers was informed by Government's concern over the vacuum created due to the unwillingness of conventional Insurers to accept Agricultural risks, which they considered too risky.

This led to the establishment of the Nigerian Agricultural Insurance Scheme on 15th of November, 1987.The implementation of the Scheme was initially vested in the Nigerian Agricultural Insurance Company Limited, which was later incorporated in June, 1988 but later turned into a Corporation in 1993 by the enabling Act 37 of 1993.Nigerian Agricultural Insurance Corporation is therefore a wholly-owned Federal Government of Nigeria insurance company set up specifically to provide Agricultural risks insurance cover to Nigerian farmers.

Vision
To remain the pioneer and leader in the country's Agro-investment risk management and the preferred choice for general insurance.

Mission
Making investment in Agriculture and other sectors of the economy more attractive through efficient risk management that ensures prompt settlement of claims thereby improving Agricultural output and promoting National Development.

Risks in Agricultural undertakings are more widely spread and far reaching than in most other enterprises. This is because they go beyond all the well-known and researched entrepreneurial hazards and uncertainties of the modern business world. Such hazards include the vagaries of nature, inclement weather conditions, pests and diseases along with flood and fire outbreaks. All of these impact very seriously on the success or failure of any agricultural enterprise. Therefore, any nation with a clear vision for boosting its agricultural production so as to meet the food needs of its populace and industries must of necessity put in place mechanisms that would reduce these risks and uncertainties to a bearable minimum. Therefore, the need, for a mechanism that functions specially to keep the farmers in business cannot be over-emphasised; hence the necessity for an agricultural insurance scheme in Nigeria.

3.3.3.1 Objectives of Nigerian Agricultural Insurance Corporation

The broad objective of the Nigerian Agricultural Insurance Corporation (NAIC) is to protect the Nigerian farmer from the effects of natural hazards by introducing measures which shall ensure a prompt payment of appropriate indemnity (compensation) sufficient to keep the farmer in business after suffering a loss.

The Scheme is specially designed to:

- promote agricultural production since it would enhance greater confidence in adopting new and improved farming practices and at the same time bring about greater investments in the agricultural

sector of the Nigerian economy, thereby increasing the total agricultural production;
- provide financial support to farmers in the event of losses arising from natural disasters;
- increase the flow of agricultural credit from lending institutions to the farmers;
- minimise or eliminate the need for emergency assistance provided by government during period of agricultural disasters.

3.3.3.2 Problems of Nigeria Agricultural Insurance Scheme

The efficiency of agricultural insurance scheme in Nigeria has been hampered by the following factors:

(i) Inadequate infrastructure and administrative facilities
(ii) Shortage of trained manpower
(iii) Ignorance of farmers on the functions and merit of the scheme
(iv) Non-availability and unreliability of data useful for insurance purpose and
(v) Inadequate and untimely funding.

(i) Inadequate infrastructure and support services

Inadequacy of infrastructural facilities such as good roads and other efficient means of transportation, good communication facilities, uninterrupted power supply, could hamper the successful operation of the scheme. These facilities are needed in order to facilitate prompt and speedy intimation of losses by the farmers for assessment of losses and payment of indemnities.

(ii) Inadequate funding

Adequate and timely funding of the scheme will be essential for its success. Agricultural insurance is a very costly venture and as such, arrangement for adequate funding should be made. Delay in approving and releasing funds and especially undue political interference in funding and management of the scheme will affect its success.

(iii) Lack of trained personnel

The scheme requires the availability of personnel trained in agriculture and insurance at the national, state and local government levels as evaluator, supervisors, loss adjusters, salesmen and extension staff.

(iv) Ignorance and lack of awareness of the scheme by farmers

The ignorance and lack of awareness by the majority of farmers of the need, practice and values of agricultural insurance, constitute problem to the scheme.

(v) Lack of data

A major problem affecting the scheme is the dearth of data on farm operations, particularly on crop yields and losses arising from natural hazards. These data are necessary for the computation of premiums and indemnities.

3.3.4 Perils Cover

The risks covered by NAIC are:

(a) in the case of crops, damage or loss caused by
  (i) fire, or
  (ii) lightning, or
  (iii) windstorm, or
  (iv) flood, or
  (v) drought, or
  (vi) pests, or
  (vii) invasion of farm by wild animal; and

(b) in the case of livestock, death or injury caused by
  (i) accident, or
  (ii) disease, or
  (iii) fire, or
  (iv) lightening, or (v) storm, or (vi) flood.

3.3.5 Conditions for the Insured

1. A person insured under the Scheme shall satisfy such conditions relating to good husbandry as may be laid down, from time to time, by the Corporation.
2. The rate of insurance premium payable under the Scheme by farmers shall be such percentage of the sum assured as the Corporation may, from time to time, determine having regard to the pure risk premium, reserve premium and administrative loading.
3. The Corporation shall subsidise the premium payable at such rate not exceeding 50 per cent as it may, from time to time determined. Subsidy on premium shall -
  (a) be paid to the Corporation by the Federal Government and the respective State Governments in the proportion of 37.5 per cent and 12.5 per cent respectively; and
  (b) for a particular year, be paid within the first quarter of the following year.

Where a State Government defaults in its payment to the Corporation, the Federal Government shall cause the amount to be deducted from funds due to the defaulting State and remitted direct to the Corporation.

3.3.6 Loss Assessment and Indemnity Determination

In insurance mechanism, each insured person contributes to a common fund from which any unfortunate one who suffers a loss caused by the insured peril is paid a certain amount. In order to maintain equity between these policy holders, each insured should contribute an amount commensurate to the risk he transfers to the common fund. The process of assessing and selecting risks for insurance company to accept is called **underwriting**. This involves: **risk assessment**, which is the measurement and evaluation of the proposed risk; based on available information and documents regarding the risk. **Premium rating** that is based on sum insured and varies from one place to another. Fixing policy terms and conditions is a legal document evidencing the contract between the insured and the insurer. Loss assessment is a process of determining the loss/damage sustained by an insured. An appointed official from or outside the insurance company carries this out. An assed loo/damage must be capable of qualification in monetary terms to enable payment of an indemnity. Here, there is an elaborate institutional procedure to be followed in this task (Akubuilo, et al. (2007).

The process of determining the loss/damage sustained by the insured is often the responsibility of an official from within or outside the insurance company. Loos or damage must be quantified in monetary terms to enable indemnity payment. The expected maximum yield and expected production cost are the two major methods used in the payment of claims in agricultural insurance.

The Expected Maximum Yield (EMY) method seeks to provide the insured an insurance protection sufficient to be equal to what benefit should have accrued to him if there were no farm business failure owing to the impact of the insured peril. This method is fraught with difficulties as some elements of the subjectivism and manipulations are often involved in estimating what should constitute the EMY. This creates an atmosphere of dispute and dissatisfaction between the insured and the insurer. As a result, the EMY method is usually abandoned in favour of the expected production cost method.

The Expected Production Cost (EPC) method is a very popular and straightforward wary of dealing with risk compensation. Here the insured farm enterprise seeks to recover the costs of his operations before the perils insured against occurred. This method does not create room for manipulations and disagreement over risk compensation since there is

usually a schedule of costs of operation in the agribusiness venture beginning from the first day to maturity or harvest of crops or livestock. Indemnity calculation in this method is simply the summation of cost of land acquisition and preparation, seeds/seedlings/livestock breeds, agro-chemicals, feeds and drugs, weed control, labour and other inputs. The objective of the expected production cost method is to restore the insurer back to business after the occurrence of the mishap. However, indemnity computation in Nigeria is dependent on product varieties that vary from one ecological zone to another (Esheya, 2011).

However, indemnity shall be based:

(a) in the case of crops, on approved input cost up to the time the loss occurred but if some crops were salvaged then, less the value of the crops actually harvested;
(b) in the case of livestock, on a valuation table to be prepared by the Corporation for each class of stock; and
(c) in the case of crops, livestock and other agricultural items specified, from time to time, by the corporation, on agreed value of the crops, livestock or item.

A farmer shall not qualify for indemnity under this Decree unless

(a) the insurance cover was obtained before the damage or loss occurred;
(b) he has a valid insurance cover at the time of damage or loss;
(c) followed laid down practice for crop and livestock production;
(d) the cause of damage or loss was one of the risks covered by the insurance policy;
(e) the notification of the damage or loss was made within the stipulated time; and
(f) he has satisfied such other conditions as the Corporation may, from time to time, specify.

Self-Assessment Exercise

1: List the objectives of NAIC.
2. Describe the basic principles underlying agricultural insurance.

3.4 Conclusion

Agricultural Insurance is relatively new in Nigeria and the benefits thereof have not been harnessed by farmers. NAIC is the only formal agricultural insurance company in Nigeria and their scope of operations is limited compare with scope of operations of agricultural insurance in developed countries.

3.5 Summary

In this unit, you have learnt about the agricultural insurance in Nigeria. The mission, vision and objectives of Nigerian Agricultural Insurance Corporation as well as the hindrances to its performance efficiency are considered.

3.6 References/Further Reading/Web Sources

Aina, O.S. & Omonona, B.T. (2012). 'Nigeria Agricultural Insurance Scheme (NAIS): Prospect, Achievement and Problems'. *Global Advanced Research Journal of Agricultural Science, 1(5),* 97- 103.

Esheya, S.E. (2011). Rudiments of agribusiness finance management for tertiary institutions. Abakaliki: Legro Press.

Nigeria Agricultural Insurance Scheme (NAIS). (1989). Operational Guideline for the Nigerian Agricultural Insurance Company.

3.7 Possible Answers to Self-Assessment Exercises

1: List the objectives of NAIC

- promote agricultural production since it would enhance greater confidence in adopting new and improved farming practices and at the same time bring about greater investments in the agricultural sector of the Nigerian economy, thereby increasing the total agricultural production;
- provide financial support to farmers in the event of losses arising from natural disasters;
- increase the flow of agricultural credit from lending institutions to the farmers;
- minimise or eliminate the need for emergency assistance provided by government during period of agricultural disasters.

2. Basic principles underlying agricultural insurance include:

- **Proximate Cause-** This principle implies that before compensation can be paid, it must first of all be proved that the loss suffered was approximately caused by the event insured against. Thus, if a farmer insures his crop against fire but encountered flood, the insurance company will not entertain a claim under the policy.
- **Subrogation-** This refers to the right an insured has to acquire the insured's rights as well as his remedies against third parties. It is a situation where an insured has been fully compensated by the

insurer but where alternative possibilities for compensation remain, by using a third party who is considered to have caused the loss. The insurer should take over the right to pursue this; otherwise, the insured could breach the indemnity principle. For instance, if an insurance company indemnifies a farmer for his tractor damaged in an auto-crash, he can neither sell the scrap nor claim some money from the third party whose negligence must have caused the accident. It is the right of the insurance company to receive the scrap value of the tractor, sue or even collect money from the third party in agreement with the indemnity principle.

- **Utmost Good Faith-**Insurance is a contract of 'unberrimae fidei'. This implies that both the insurer and he insured must disclose all material facts regarding the subject matter of insurance. There must not be an attempt of any kind by any of the parties to deceive each other. Facts must be disclosed honestly and accepted prudently by the insured and insurer respectively.
- **Indemnity-** Excepting life assurance, the object of insurance is to restore the insured to the position he was in before the insured event occurred by aiming at putting him in the same position after the loss as he was before the loss. It should not be possible to gain a profit from the payment of insurance claim. Indemnity principle is a protection against loss, but only the loss and no more.
- **Insurable Interest-** The insured only enters into a valid contract if he does actually stand a chance to suffer a financial loss or liability on the occurrence the event insured against. Thus, one neither insures the property of others nor their lives. However, ownership of the property to be insured is one of the recognized relationships in insurance. A mortgage may insure a property mortgaged to him; an employer may insure the life of his judge; husband and wife may insure one another; a creditor may insure the life of his debtor as the case may be. Each has an insurable interest in the life of the other depending on the existing relationship.
- **Consequential Loss-** Compensation cannot be claimed for a loss that is designated a consequential loss unless it is clearly provided for in the contract. Losses insured as a result of the intentional action of the insured is called a consequential loss.

Unit 4 Risk Quantification

Unit Structure

4.1 Introduction

Risks that cannot be assessed quantitatively in terms of financial loss cannot be insured. The impact of risks and the severity of its impact are important information that is necessary for risk assessment. Risks must be evaluated in relation to their potential severity of impact after they have been identified. Generally, the assessment is in terms of the negative impact, such as damage or loss and to the probability of the occurrence of the risks.

4.2 Intended Learning Outcomes

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

- define risk assessment
- identify the variables that should be quantified in risk measurement
- quantify agricultural risks.

4.3 Main Content

4.3.1 Meaning and Components of Risks

Risk assessment is a systematic process for identifying and evaluating events (i.e. possible risks and opportunities) that could affect the achievement of objectives, positively or negatively. A robust risk

assessment process forms the foundation for an effective enterprise risk management program. Although being aware of a risk is clearly important, before one can consider managing it, one must actually assess the risk being considered. Risks (and their impacts) are assessed by quantifying three main variables: hazard, vulnerability, and exposure.

4.3.1.1 Hazard

Hazard is the categorisation of the type of risk being considered—for example, weather, price, pest, policy, or market. The quantification of the hazard is then undertaken by assessing three sub-variables:

Likelihood/frequency
How often or likely is the risk to occur? Estimate the probability of the hazard. Probability tells you how often the hazard will affect some operation within the mission. If you have reliable data available, you can also express probability as a number, in terms of a ratio or as a percentage. Express the level of probability by using the following ranking levels-keep in mind the cumulative probabilityof the causes listed for the hazard. For example, if there are four causes for a single hazard, the probability of its number occurrence will be greater than if there were only one cause. For future reference, farmers or farm manager should document the occurence of hazard in their farms which can be used to assigna probability to each hazard. Frequency of Hazard can be documented thus:

- **Frequent -** occurs often, continuously experienced
- **Likely -** occurs several times
- **Occasional -** occurs sporadically
- **Seldom -** unlikely, but could occur at some time
- **Unlikely -** can assume it will not occur
- **Severity** This refers to the impact of loss from a risk. This, also, refers to the measurement of the amount of loss as against the frequency of the loss. In essence, the frequency of loss determines its value to the organisation. Severity of loss implies how grave the loss will be in terms of its occurrence to the organisation. In other words, severity measures the quantum of the loss of a risk that can occur or that had already occurred. Severity: What are the likely fiscal impacts of such a risk if it occurs? The severity assessment should be based on the worst possible outcome that can be expected. It is expressed in terms of the impact on mission, people, materials, facilities, and environment.

Spatial extent
Spatial extent refers to the widespread of the impact of the risk in terms number of persons, village towns and/or the country affected.

4.3.1.2 Vulnerability

is an estimation of what the impact of the realised risk would be given the assets affected by the event and taking into account the current ability to manage the impact.

4.3.1.3 Exposure

Exposure is the first action in assessing risk. Remember that exposure is the number of resources (personnel or equipment) affected by a given event or by repeated events over time. Exposure is the identification of the location of crops, livestock, and farm holdings that may be directly impacted by the hazard. Interdependency in the supply chain leads to indirect exposure for other parties. Exposure can be expressed in the following terms:

- **Time** - how long resources are exposed to the hazard?
- **Proximity** - how close to resources would the hazard occur?
- **Volume** - the number of resources affected by the hazard?
- **Repetition** - the frequency with which the hazard would recur?

Although exposure is a component of risk, it is not used directly in assigning a level of risk. However, you should consider the exposure potential when assigning levels of probability and severity. Clearly, this process of risk assessment involves the use of a number of assumptions and variables, so risk modeling is increasingly used as a tool to allow the development of probability estimates for financial losses.

It should be noted that agricultural risk assessment is particularly dependent on the relationship between the timing of the loss event and the agricultural calendar. This is largely due to the fact that crop or livestock vulnerability varies according to the growth stage and season. In addition, risk assessment in agriculture is further complicated by the fact that vulnerability is heavily influenced by many local variables, such as soil, crop varieties, cultural practices, irrigation, and drainage. The use of and access to local knowledge and information is therefore essential to the interpretation of agricultural risk within a given area.

4.3.2 Potential Severity of Impact of Risk

Basically, in the assessment of risks it is important to engage in the best approach to decisions in order to properly plan for the implementation of the risk management plan. Herein is the essence of best educated opinions and available statistics as the primary sources of information. The basic difficulty in risk assessment is the determination of the rate of occurrence because of the fact that statistical information is not available on all kinds

of past incidents of risks. In addition, evaluating the severity of the impact or consequences is often quite difficult in terms of intangible assets.
The valuation of assets, generally, possesses some issue that needs to be resolved in risk assessment. Essentially, risk assessment is normally meant to produce information for the management of the organisation. It is obvious that such information will indicate that the primary risks of operations are easy to understand. The information produced from risk evaluation will also allow for the risk management decisions to be prioritised. There have been several theories and attempts to quantify risks. Perhaps the most widely accepted formula for risk quantification among the numerous different risk formulae is expressed below.

Risk Magnitude = Rate (or probability) of Occurrence x **Impact of the Event.**

4.3.2.1 Composite Risk Index

For the composite risk index, the above formula can also be used by rewriting it as follows:

Composite Risk Index = Impact of Risk event x Probability of Occurrence

The impact of the risk event is commonly assessed on a scale of 1 to 5, where 1 and 5- the minimum and maximum possible impact of an occurrence of a risk. The impact of the risk is usually expressed in terms of financial losses. However, the 1 to 5 scale can be arbitrary and need not be on a linear scale given that fact that financial terms are used for the losses. Just like the impact of risk, the probability of occurrence is likewise commonly assessed on a scale from 1 to 5, where 1 represents a very low probability of the risk event actually occurring while 5 represents a very high probability of occurrence.

This alignment may be expressed in either mathematical term such as; event occurs once a year, once in ten years, once in 100 years etc. Alternatively, it may be expressed in narrative form such as; event has occurred here very often; event has been known to occur here; event has been known to occur in the industry etc. Basically, the 1 to 5 scale can be linear or non-linear depending on decisions or approaches as decided by the subject-matter experts in the field of risk assessment. The Composite Index thus can take values ranging typically, from 1 through 25, and this range is usually arbitrarily separated into three sub-ranges. The overall risk assessment is then categorised as Low, Medium or High; all depending on the sub-range containing the calculated value of the Composite Index. For instance, the three sub-ranges could be defined as 1 to 10, 11 to 20 and 21 to 30.

Generally, the probability of risk occurrence is difficult to estimate. This is because the past data on frequencies are not readily available, as indicated earlier in this discussion. Similarly, the impact of the risk is not easy to estimate since it is often difficult to estimate the potential loss in the event of risk occurrence. Further, the above factors can change in magnitude depending on the adequacy of risk avoidance and prevention measures instituted by the organisation. It is also due to changes in the external business environment. The above reasons imply that it is critically necessary for the risk manager to periodically reassess risks and intensify or relax mitigation measures as the case may demand. Similarly, changes in environmental variables such as procedures, technology, schedules, budgets, market conditions, political environment will typically call for reassessment of risks.

4.3.3 Elements of Decision Making under Risk

Decision making under risk involves probabilities, measures of variability, expected values, and expectations. Many farmers utilise these concepts, often without recognising them. The following sections are designed to help farmers recognise and understand these elements of their decision making.

Crop yields and annual average prices received by farmers, as well as many other economic outcomes, occur much like the normal curve distribution. The average value tends to be the most frequent outcome, and the pessimistic and optimistic values are much less frequent. Whether outcomes exactly follow the normal curve is relatively unimportant. In decision making, we need to remember that yields or prices which are near the average are much more frequent (more likely) than either very high or very low prices or yields.

4.3.4 Measuring Variability

Variability of outcomes is generally associated with risk, and typically riskier situations have greater variability of outcomes. The average outcome is the most frequent or most likely if outcomes are normally distributed, but the average does not provide information about variability. The range-the highest and lowest values-combined with the average does provide some information about variability. However, it is difficult to make comparisons of variability between crops or prices. The coefficient of variation is a statistical measure of variability based on all of the values for yields or prices, not just the high, low, and average. The coefficients of variation can be used to make comparisons of variability among crop yields or prices; the lower the coefficient of variation, the lower the variability. For example, assume corn yields averaged 1100Kg per hectare with a coefficient of variation of 15.0 percent. For soybeans,

yields average 350Kg per hectare with a coefficient of variation of 10.0 percent.

In this example, soybean yields are relatively less variable from year to year than corn, as indicated by the smaller coefficient of variation. Furthermore, if yields are distributed like the normal curve, two thirds of the time soybean yields would be expected to fall within plus or minus 10 percent of 350Kg. Two thirds of the time soybean yields would be expected to be in the 315 to 385Kg per hectare range. In contrast, for corn, the range is plus or minus 15 percent or from 935 to 1265 kilogram per hectare. About one sixth of the time yields would be below these lower levels and about one sixth of the time above. Thus, optimistic outcomes, corn yields of over 1265 kilogram per hectare or 385 kilogram of soybeans per hectare or more, would be expected one year in six. Pessimistic outcomes, yields below 315 and 935 kilogram per hectare for soybeans and corn, would also be expected to occur one year in six.

4.3.5 Computing Expected Values

Many people make these comparisons every day without recognising the formal framework involved. The expected value is a mathematically derived value which weights the outcomes by their respective probabilities. Computing the expected value is a means of assigning a value to a risky alternative.

What is the expected value of a ticket in a raffle with 10,000 tickets and a prize worth ₦25,000? Because 9,999 tickets do not win the prize and only one does, we can compute the expected value of a ticket as:

₦0	x	.9999	=	0
₦25,000	x	.0001	=	2.50

				₦ 2.50

In this case, the number of tickets and the prize are both known with certainty. Whether an individual buys a raffle ticket with an expected value of ₦2.50 for ₦2.50 depends on one's attitude toward risk in this situation. A risk averse individual would not buy the ticket, but a risk preferrer would be willing to pay more than ₦2.50. (Even a risk avoider may buy a raffle ticket with an expected value of ₦2.50 for $5.00 if sold by a charitable organisation, but risk concerns are unimportant in this situation.

In other situations, the probabilities and/or the outcomes may not be known with certainty. In this case, individuals typically use their expectations about the future to determine expected values. For example,

assume that enterprise "A" is "most likely" to give a net return of ₦50 per hectare. An "optimistic" estimate of net returns is ₦150, and a "pessimistic" estimate is a loss of ₦100 per acre. If the optimistic and pessimistic outcomes each occur one year in six, the expected value of enterprise A can be computed as:

₦150	x	1/6	=	₦25.00
50	x	4/6=		33.33
	-100	x	1/6	= -16.67

				₦41.66

Note that the probabilities 1/6, 4/6, and 1/6 sum to one. All of the outcomes which could occur have been accounted for in estimating the expected value.

An alternative enterprise, "B," may have a "most likely" net return of ₦40 per hectare. The "optimistic" and "pessimistic" estimates of net returns are ₦90 and ₦20 per hectare respectively. Assuming the same probabilities of outcomes for enterprises A and B, the expected value of enterprise B can be calculated as:

90	x	1/6	=	₦15.00
40	x	4/6	=	26.67
0	x	1/6	=	-3.33

				₦45.00

In these examples, the expected value of enterprise B is greater than that of enterprise A. Although the estimates of the most likely and optimistic estimates of returns for enterprise A are higher than for enterprise B, this is more than offset by the differences in the pessimistic returns. In this situation, with other things being equal, most decision makers would prefer enterprise B.

The expected value of an alternative is affected by estimates of both probabilities and net returns. The two calculations below indicate different assumptions for enterprise A. In the first, it is assumed that the optimistic returns will occur 2 years in 6 and the most likely 3 years in 6. In the second, it is assumed that the most likely return is ₦75 instead of ₦50 with the same probabilities as in the original example. The expected values are:

Calculation l	Calculation 2
150 x 2/6 = $50.00	₦150 x 1/6 = $25.00
50 x 3/6 = 25.00	75 x 4/6 = 50.00
-100 x 1/6 = -16.67	-100 x 1/6 = -16.67
------	--------

₦58.33 ₦58.33

The expected values in both calculations are exactly the same and are higher than the expected value for enterprise B.

Although computing an expected value of an alternative is a mathematically precise procedure, individuals may have different expected values for the same alternative. This occurs because people differ in their assessments of both the outcomes which may occur and the probabilities with which they may occur. Very few individuals will routinely compute the mathematically expected value, but the concept is useful in decision making because both the range and probability of possible outcomes are considered.

Self-Assessment Exercise

1: Express exposure in its related terms.
2. What is risk assessment?

4.4 Conclusion

Risk measurement requires risk assessment. Risks are assessed on the basis of three variables namely, hazard, severity and exposure. Risk can be measured by multiplying probability of occurrence with risk impact. An accurate farm record with respect to risk occurrence is a necessary tool in assigning the probability and risk impacts in terms of financial losses.

4.5 Summary

In this unit, you have learnt about risk measurement, severity of risk, variability measurement and expected values computation.

4.6 References/Further Reading/Web Sources

World Bank. (2005). *Agriculture Investment Sourcebook. Module 11: Managing Agricultural Risk, Vulnerability, and Disaster*. Washington, DC.

4.7 Possible Answers to Self-Assessment Exercises

1: Express exposure in its related terms

- **Time** - how long resources are exposed to the hazard?
- **Proximity** - how close to resources would the hazard occur?
- **Volume** - the number of resources affected by the hazard?
- **Repetition** - the frequency with which the hazard would recur?

2. Risk assessment is a systematic process for identifying and evaluating events (i.e. possible risks and opportunities) that could affect the achievement of objectives, positively or negatively. A robust risk assessment process forms the foundation for an effective enterprise risk management program. Although being aware of a risk is clearly important, before one can consider managing it, one must actually assess the risk being considered.

Module 6 Roles of Government and Information Technology in Risk Management

Unit 1 Roles of Government in Risk and Uncertainty Management

Unit Structure

1.1 Introduction

Risk and uncertainty are ubiquitous and varied within agriculture and agricultural supply chains. This stems from a range of factors including the vagaries of weather, the unpredictable nature of biological processes, the pronounced seasonality of production and market cycles, the geographical separation of production and end user, and the unique and uncertain political economy of food and agricultural sectors, both domestic and international. One major role of agriculture is the production of food. Risk and uncertainty in agriculture is therefore has a direct effect on the achievement of the millenial goal of food security by both developed and developing countries. It is on this premise that government

at all levels must not be passive but active participants in risk management in agriculture.

1.2 Learning Outcomes

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

- explain layers of risk
- identify the risk layers that require government intervention
- state the rationale for government intervention in risk management
- discuss the government policies targeted at risk management.

1.3 Main Content

1.3.1 Layers of Risk

There are different layers of risks in agriculture which require different responses:

- Normal variations in production, prices and weather do not require any specific policy response. They can be directly managed by farmers as part of normal business strategy.
- At the other extreme, infrequent but *catastrophic* events that affect many or all farmers over a wide area will usually be beyond farmers' or markets' capacity to cope. A severe and widespread drought is one example. The outbreak and spread of a highly contagious and damaging disease is another. Governments may need to step in.
- In between the normal and the catastrophic risk layers lies a *marketable* risk layer that can be handled through market tools, such as insurance and futures markets or through cooperative arrangements among farmers. Examples of such marketable risks include hail damage and some variations in market prices.

1.3.1.1 Normal Risk

Within the normal risk layer, farmers are responsible for managing their own business risk. The set of risk management strategies is decided at the farm or household level, particularly for frequent "normal" small risks in production, prices and weather. This is because farmers know best about their individual risk environment and how much risk they are willing to carry. Governments may need to play a role within the normal risk layer by encouraging farmers to develop their own risk management strategies.

Training programs on how to use risk management techniques including good farming practices, the role of diversification and the use of futures

and insurance can improve farmers' ability to assess and manage their risk using a variety of market and on-farm tools. Income tax and social security provisions can be adjusted to the needs of farmers. For example, paying taxes on average taxable income across a few years can help farmers to cope with incomes that are quite variable from year to year. Tax incentives for saving may also encourage farmers to smooth income flows from year to year.

1.3.1.2 Marketable Risk

Some types or levels of risk can be dealt with using market instruments. Some large, export-oriented farmers, cooperatives and downstream industries make direct use of futures contracts in order to hedge their price risk. Many more farmers benefit indirectly from the price discovery mechanisms that these markets offer. Production and marketing contracts between farmers and the downstream industry or cooperatives is another important and increasingly sophisticated risk management tool. There is a role for government in making sure that the legal system properly underpins the development of these contracts, allowing enough flexibility and security of transactions.

Governments can also help in training farmers and their organisations so that they are better able to use these instruments themselves. Where there is sufficient convergence of interests, farmers can act collectively as members of cooperative society or communal effort to generate services necessary for risk management and implement collective risk management strategies.

1.3.1.3 Catastrophic Risk

Governments have an important role to play in managing catastrophic risks. These are defined as large but rare events that cause very significant damage over a wide area and to many producers, to the extent that neither individual producers nor available market instruments are able to cope. When a disastrous event such as extreme weather or a disease outbreak occurs, the government will come under social, media and political pressure to take action. A set of procedures and a clear delineation of responsibilities between government and producers, defined as part of a contingency plan, are needed to manage such pressures and for the good governance of disasters. They should include explicit triggering criteria and a definition of the types and levels of assistance. Getting the balance right between rules decided in advance and discretionary decisions made after the event is important. Otherwise, hasty recourse to ad hoc decisions will undermine the contingency plans.

Poultry industry in Nigeria experience catastrophic risk when there was outbreak of bird flu which claimed thousands of birds in different parts of the country. Government came to the rescue of farmers that their farms were affected by giving them relief assistance. In the same vein, crop producers that were affected by floods in Kogi State and some other states of the federation in 2012 also received relief assistance. The relief assistance granted to farmers that experienced catastrophic risks was not pre-planned, rather it was an emergency. In developed countries and some less developed countries, the government explicitly delimits its responsibility in advance of any catastrophic event, as well as to tailor assistance according to the severity of the event when it occurs. This eases political pressures and simplifies the decision-making process to provide assistance in the event of catastrophes.

1.3.2 Rationale for Government Intervention in Agricultural Risk Management

Government intervention in markets can incur costs and create economic distortions. Thus, any interventions to manage risks in agriculture must be justified with a clear rationale, with any costs outweighed by benefits or returns to intervention. Ideally, governments should intervene only when the market has 'failed' (or is expected to fail) to provide a satisfactory outcome, and this outcome can be improved by government policy. Two main reasons have been adduced for policy intervention by government:

(i) to address inefficiencies in the operation of markets and institutions; or,
(ii) to address inefficiencies on equity or distributional grounds. Inefficiencies can arise in agricultural risk markets from three sources:
- imperfect (or costly) information;
- the existence of 'externalities';
- where insufficient competition in agricultural risk markets give rise to market power for providers of risk management instruments (e.g. insurers).

1.3.2.1 Information Costs

Markets for risk management services in agriculture require information on the magnitude and probability of losses faced by farm businesses in order to function efficiently (Bielza Diaz-Caneja et al. 2009). The highly unpredictable and diverse nature of risks in agriculture means this information is often unknown or very costly to acquire, both for farmers and for providers of risk management services. The result is that the coverage of information is incomplete and unequal between participants

in risk markets (e.g. farmers and insurance companies). In agriculture, problems of incomplete or asymmetric information tend to be greater in yield risk than price risk as farmers have more control over the former. Asymmetric information can lead to some farmers being 'priced out' of markets for risk management services, as providers cannot distinguish between high and low risk businesses and so set premiums based on average risk, making protection (such as insurance) prohibitively expensive for farmers who are less 'risky' than average. Additionally, informational problems provide scope for 'moral hazard', as farmers may take fewer measures to reduce risk in the knowledge that they will receive compensation, such as an insurance payout, in the event of an adverse outcome. Given the costs of acquiring and processing a suitable level of information are likely to be particularly prohibitive or burdensome for smaller farms, it also gives rise to distributional or equity issues.

Thus, regarding information costs, there may be a direct role for government to intervene to facilitate research to generate missing information (e.g. into weather patterns, disease prevalence to quantify risk). Government can also take steps to reduce the costs of sharing information between, for example, farmers and insurance companies, in order to overcome problems of asymmetric information.

1.3.2.2 Externalities

In economic terms, an externality exists when there is some cost or benefit that accrues to an outside party from a market transaction or decision that is not fully factored into market prices (and hence the decision).A relevant example for agriculture is that of animal and plant disease. In these cases, the provision of insurance will require the insurer to obtain information to inform the level of risk that an individual business applying for insurance may suffer a loss due to plant or animal disease. However, for any single business, the risk of a loss will depend not only on the level of investment in bio-security by that business, but also in the bio-security of neighbouring farms. Thus, to be able to determine the premium, the insurer needs information beyond that of the applicant, which can be costly to obtain. In this case, externalities in agriculture can exacerbate information problems, meaning the provision of insurance for potential losses due to animal and plant diseases is most likely to remain incomplete – provided at suboptimal levels or not provided at all.

1.3.2.3 Market Power

Where a market is characterised by very few suppliers, as is the case in many markets for agricultural insurance, the suppliers will tend to have some power to influence market prices and ultimately the ability to generate economic rent or "abnormal profits". This is an indicator of lack

of competition in agricultural insurance markets. The result is that even subsidies on insurance premiums do not always benefit farmers, as suppliers of agricultural insurance are able to capture such subsidies as economic rent. In such cases, Government may have a role in improving market competition by, for example, removing barriers to entry to increase competition in the insurance market.

1.3.3 Distributional Concerns

In addition to economic efficiency grounds, government intervention may be justified by concerns over the distribution of market outcomes. It is possible to argue that agricultural enterprises are less able manage risk privately than operators in other industries due to the relatively small size of many farm businesses, and the relatively low profit margins on which they operate (Matthews, 2010). Additionally, risk exposure in agriculture may be high relative to other industries, due to the greater uncertainty on the wide range of factors on which agricultural businesses depend.

As discussed earlier on, agricultural output prices are particularly volatile due to the unresponsive nature of demand for food products to price changes and to the presence of other risk sources, such as weather and disease. The ability to cope with and manage risk also differs within agriculture and between agricultural businesses, due to the type of enterprises, size of business and other factors. Thus, there may be justification for intervention by government on the basis that farm businesses and households are more vulnerable to some risks than those that draw their income from other sectors.

1.3.4 Risk Management Related Policies in Agriculture

Organisation for Economic Co-operation and Development (OECD) studies show that risks in agriculture are interconnected, sometimes compounding, sometimes offsetting each other. For example, if the prices of inputs (e.g. fertilizer) and outputs (e.g. agricultural commodities) move in the same direction the impact on net returns is reduced. Production risks can be partially offset by price movements, as when crop yields are low but prices are high. It is the net risk effect on income that matters, and income variability can be significantly reduced thanks to these interconnections. While all agricultural policies affect the risk environment faced by farmers and their responses to risk, certain policies can be seen as more targeted at reducing or mitigating risk or helping farmers cope with adverse outcomes. The main driver for agricultural policy and among its objectives is the stabilisation of agricultural markets.

1.3.4.1 Price Stabilisation Policies

There is a range of policy instruments that have traditionally been used at country or regional levels to reduce the exposure of the agricultural industry to market or price risks. Broadly, these policies are targeted at addressing problems associated with output price volatility. A broad list of these policies is provided below.

a. Export subsidy

Export subsidy is a government policy to encourage export of goods and discourage sale of goods on the domestic market through low-cost loans or tax relief for exporters, or government financed international advertising or research and development. Export Subsidies are also generated when internal price supports, as in a guaranteed minimum price for a commodity, create more production than can be consumed internally in the country. Export subsidies are payments made by the government to encourage the export of specified products.

b. Import tariffs

An import tariff is a tax placed by governments on commodities that are shipped into a country from a foreign country. These taxes are often a way to discourage a country's consumers from buying products from another country and to support domestic products and services. Governments generally have the right to determine what products will have a tariff and how much that tax will be. Governments often use two types: *ad valorem* and specific. A specific tariff is a set tax on a product, and this tax is the same on all products of its kind. An ad valorem tariff, on the other hand, is a tax based on a percentage of the value of the product. This tariff can change from time to time as the value of the product increases or decreases. Governments also can impose a two-part tariff, which includes a specific and an ad valorem tariff. A product with a two-part tariff would have a set tax as well as a value-based percentage tax.

An import tariff that is sufficiently high can protect producers from variability in world prices by limiting imports. However, this can be at the expense of higher prices and reduced choice for consumers. If government imposes a high tariff on agricultural products like rice, maize, wheat etc., it will help in mitigating price risk because it will make imported agricultural products more expensive than the domestic products; thereby compelling the citizen of that country to consume locally produced agricultural products.

c. Guaranteed agricultural prices

It involves enactment of legislation giving the farmer more or less precise guarantee of the price level or the minimum price he may expect some time ahead. These prices generally lie within certain fixed percentages of

the parity prices. Several years ago Nigeria had a system of guaranteed prices under which minimum support prices are announced by Government for major food grains and cocoa well in advance of the saving season with the clear objective of mitigating price uncertainty. One of the major uncertainties which afflict farming activity emerges from frequent phenomenon of sudden and precipitous fall in prices of agricultural commodities. The objective of guaranteed minimum prices as universally understood is to remove this uncertainty.

d. Buffer Stock (Intervention purchasing & public storage)

It also aims at removing price uncertainty. In this method, the buffer stock authority, or Government agency, purchases stocks of agricultural commodities in years of bumper harvest & unloads them into the market in years of crops shortages with a view to raising price in times of glut and lowering them in times of scarcity. Thus, by neutralising year to year fluctuations in output, buffer stock operations can bring about greater regularity in the year to year availability of crops and at the same time promote rational economic decision on the part of farmers by reducing price uncertainty. In Nigeria, buffer stock scheme is mainly for grain crops- especially maize, for which government built silos in several locations in the country.

An essential condition for smooth and efficient functioning of the buffer stock scheme is that the buffer stock authority must be able to maintain a balance between its purchases and sales over a period. Continuous purchase, by buffer stock operating agency of a commodity due to its glut in the market for a very low period will put a great strain on the resources of the concerned agency. Its continuous sale for a very long period will lead to a complete exhaustion of its stock lying with the agency. Both ways, the operations of buffer stock scheme will suffer. This implies that buffer stock schemes will be more successful if the price changes, needed to be controlled are not unidirectional only.

Buffer stock operating agency must fix judiciously, the ceiling and floor prices which it wants to maintain. If the ceiling price is fixed at quite a high level and the floor price at rather a low level, then the scheme would be very easy to implement but it may not achieve any meaningful stabilisation because a high ceiling price and a low floor price of the concerned commodity can fluctuate without any interference. If the ceiling price it relatively low and the floor price high, the degree of price stabilisation achieved would be high but this may jeopardise the scheme itself because the buffer stock authority would be required to purchase stocks even in case of wild glut and to sell stocks even when there is only a little fall in production.

Self-Assessment Exercise

1: What is marketable risk?
2. What is export policy?

1.4 Conclusion

In this unit, you have learnt about the need for government intervention in risk management and the instrument that government uses to mitigate or assist the farmers to cope with the agricultural risks.

1.5 Summary

There are different layers of risk, namely normal risk, marketable risk and catastrophic risk. Catastrophic risk requires government intervention because of its devastating effects. Rationales for government intervention in risk management are information cost, externalities and market power. Price stabilisation policies are used by government to combat price risk vis-à-vis production risk.

1.6 References/Further Reading/Web Sources

George, F. P. *Managing Risk in Agriculture*. West Lafayette Purdue University.

Organisation for Economic Co-operation and Development. Retrieved from www.oecd.org.

1.7 Possible Answers to Self-Assessment Exercises

1: What is marketable risk?

1.
Marketable Risk*: Some types or levels of risk can be dealt with using market instruments. Some large, export-oriented farmers, cooperatives and downstream industries make direct use of futures contracts in order to hedge their price risk. Many more farmers benefit indirectly from the price discovery mechanisms that these markets offer. Production and marketing contracts between farmers and the downstream industry or cooperatives is another important and increasingly sophisticated risk management tool. There is a role for government in making sure that the legal system properly underpins the development of these contracts, allowing enough flexibility and security of transactions.*

Governments can also help in training farmers and their organisations so that they are better able to use these instruments themselves. Where there is sufficient convergence of interests, farmers can act collectively as members of cooperative society or communal effort to generate services necessary for risk management and implement collective risk management strategies.

2. Export subsidy:

Export subsidy is a government policy to encourage export of goods and discourage sale of goods on the domestic market through low-cost loans or tax relief for exporters, or government financed international advertising or research and development. Export Subsidies are also generated when internal price supports, as in a guaranteed minimum price for a commodity, create more production than can be consumed internally in the country. Export subsidies are payments made by the government to encourage the export of specified products.

Unit 2 Information and Communication Technologies (ICT) and Risk Management in Agriculture

Unit Structure

2.1 Introduction

Risk and uncertainty are ubiquitous and varied in agriculture. They stem from uncertain weather, pests and diseases, volatile market conditions and commodity prices. Managing agricultural risk is particularly important for smallholders because they lack resources to mitigate, transfer, and cope with risk. Risk also inhibits external parties from investing in agriculture. Timely information is essential to managing risk. Information Communication Technologies (ICTs) have proven highly cost-effective instruments for collecting, storing, processing, and disseminating information about risk.

2.2 Learning Outcomes

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

- identify the role of information and ICTs in risk management
- highlight specific ICT gadgets that are can be used for risk management in developing countries

- state the external supports necessary for ICTs in risk management
- discuss how ICTs can be used to mitigate agricultural risks.

2.3 Main Content

2.3.1 Central Role of Information and ICTs in Risk Management

Risk management strategies are numerous, which could be ex-ante strategies (adopted before a risky event occurs) can reduce risk (by eradicating pests, for example) or limit exposure to risk (a farmer can grow pest-resistant varieties or diversify into crops unaffected by those pests). Risk can also be mitigated ex ante by buying insurance or through other responses to expected losses such as self-insurance (precautionary savings) or reliance on social networks (for access to community savings, for example). It could also be ex-post strategies (adopted to cope with losses from risks that have already occurred) include selling assets, seeking off-farm employment etc.

All of the above-mentioned strategies-risk mitigation, transfer, and coping-have limitations, and farmers often deploy a combination of strategies to manage their risks. The mix of strategies often depends on factors like the availability and understanding of different risk management instruments, institutional and physical infrastructure, a farmer's capabilities and resource endowment, and a farmer's social network. Information about what needs to be done, when, how, and why is fundamental for smallholders and other stakeholders in the agricultural sector to implement actions to mitigate risk, transfer risk before it occurs, and determine how to cope once those events have occurred.

Farmers' information needs and sources are varied and change throughout the agricultural production cycle. Table 1 shows farmers' information needs in relation to crop cycle and market. But all farmers require a comprehensive package of information to make decisions related to risk.

Table 2.1: Farmers' Information Needs in Relation to the Crop Cycle and Market

Information on agricultural inputs	Good agricultural practices	Postharvest management	Alternative market channels
such as seed, fertilizer, pesticide	Pest management	Storage	Commodity prices
Credit	Harvesting time and techniques	Grading and standardization	Wholesale market price
Weather Soil testing	Good agricultural practices	Logistics Market information	Information Consumer behavior

Most farmers have long relied on a patchy network of local middlemen, a handful of progressive farmers, and local shop owners to receive critical information, whose reliability, accuracy, and timeliness can have a critical impact on their decision making and therefore livelihood. These are fundamental decisions, such as what price to sell the crop, where to sell (given the numerous fragmented markets), when to harvest, and when to spray pesticides to save the crop. ICTs such as the Internet, networked computers, mobile phones, and smart phones are the latest in a long line of technologies (the newspaper, telegraph, telephone, radio, and television) that support risk management practices by collecting, processing, distributing, and exchanging information.

A survey of current applications of ICTs to manage agricultural risk suggests that they are valuable for two primary reasons. First, ICTs channel information, advice, and finance to farmers who are difficult to reach using conventional channels. Secondly, ICTs reduce the costs for organisations to provide risk management services, because they can greatly reduce the costs of collecting, storing, processing, and disseminating information. These cost reductions have produced two effects that encourage private investment in ICTs to manage agricultural risk. First, previously unprofitable activities have become profitable. Second, reductions in operating costs can reduce prices for the end user. Products and services that were once too expensive for the poor have come within reach, opening a new market segment for risk management products.

The use of ICTs to manage agricultural risk is at such an early stage that it is difficult to discern trends, but interesting developments are underway.

Increasingly, the private and public sectors are collaborating to invest in ICTs that can deliver timely information to farmers. With continuing improvements in technology, software, and infrastructure, the quality and richness of that information are improving over time to address specific needs for individual farmers. Information services will allow farmers ever more interactive, two-way communication with agricultural experts and others in the agricultural innovation system. With the incorporation of ICTs, supply chains are becoming far more transparent and capable of including smallholders. The technology seems to help farmers avoid default risks and produce to consistent quality specifications, which is an important step towards participating in more lucrative commodity markets.

2.3.2 Problems of ICTs in Risk Management

If it is difficult to ascertain trends from nascent activities such as those described in the topic notes, it is even more challenging to assess outcomes and draw lessons. Many of these activities should be evaluated rigorously to determine their impacts and critique their approaches to using ICT in managing agricultural risk. Despite these caveats, several preliminary insights, cross-cutting challenges, and key enablers for risk mitigation, risk transfer, and risk coping should be noted.

2.3.2.1 Service Cost

The first key challenge and enablers of ICTs in risk management, cost of risk management services, particularly information services, customised to their needs. However, before adequate customisation occurs, most risk management services need public or private funding to support farmers' initial access. Thus, partnerships are central to assembling the combination of knowledge, skills, and resources required to manage risk through the use of ICTs. Successful efforts display cooperation between software developers, hardware manufacturers, agricultural experts, financial intermediaries, state governments and institutions, donors, nongovernmental organisations (NGOs), mobile operators, and others in the private sector.

These partners might have different incentives for participation that may not always be compatible, and different stakeholders may have different time horizons. To hold such partnerships together, an appropriate balance must be struck between stakeholders' competing interests and short- and long-term gains. Because partnerships, particularly with the participation of the private sector, are so vital in risk management, an enabling policy environment and institutional framework supporting business and entrepreneurship is a critical incentive for private investment to cope with or transfer risk. Additional fundamental elements are adequate physical

and telecommunications infrastructure for the cost-effective deployment of ICTs. Where costs are sufficiently low because mobile infrastructure is already available, more profitable opportunities may exist.

2.3.2.2 Farmers' capacity

Farmers' capacity is also a determining factor to the successful application of ICTs in risk management. Rural areas, where risk management services are so desperately needed, also lack education services, financial services, and even agricultural services. Many aspects of human capacity such as financial literacy, knowledge of best agricultural practices, and familiarity with technology are prerequisites for using risk management tools successfully. Majority of farmers in both rural and urban areas in developing countries have not fulfilled these prerequisites.

2.3.2.3 Gender Issues

Women and other vulnerable groups do not have equal access to risk management tools. Traditional cultural norms in many societies restrict women's mobility, education, assertiveness, and awareness, all of which affect their ability to acquire information or advisory services to help manage agricultural risks. The underlying structural gender constraints make them passive recipients rather than active seekers of information. Even when women proactively seek information, their access to information and ability to use it are hampered by gender norms and stereotypes. (ILO2001:6).

Theoretically, the impersonal nature of ICTs overcomes some of the traditional barriers and gender asymmetries that women face in accessing information. A mobile phone, for example, does not differentiate between a female farmer and a male farmer, but a male extension worker might. It is often difficult for women farmers to travel long distances to ascertain market prices, but a Short Messaging Service (SMS) might deliver that information without breaking any traditional stereotypes and gender norms. Very little data, disaggregated by the gender of beneficiaries, is available on the impact of ICT applications in agricultural risk management.

2.3.2.4 Trust in Information and Transfer Products

Trust in information and trust in transfer products are also critical issues in risk management. The information delivery mechanism seems to influence farmers' confidence and trust in the information as well as how they use it. Farmers in Nigeria and other developing countries are more likely to act upon information received directly from an expert than on

information provided by an automated database. Farmers are also more likely to trust and act on information they receive from a person standing in front of them than from somebody on the phone or an automated phone message.

2.3.3 Basic Requirements for Application of ICTs in Risk Management

Successful application of ICTs in risk management in agriculture requires that certain basic requirements must be fulfilled. These requirements/facilities are external support from government, nongovernmental organisations and private establishments. The requirements/facilities are listed below.

(a) Infrastructure

Basic facilities that are required for the take-off of application of ICTs in risk management are uninterrupted electricity delivery and mobile network coverage. The importance of electricity in ICTs usage cannot be overemphasized. Even if mobile network coverage is achieved in all the nooks and crannies of Nigeria, epileptic nature of electricity supply will hinder the delivery of information as at when due.

(b) Institutional and regulatory reform

There should be the reformation of traditional institutions and cultural background that can serve as a barrier to the adoption of ICTs for risk management.

(c) Business climate reforms

The business climate must be reformed in such a way that participation and innovation from the private sector in the utilisation of ICTs in agricultural risk management will be encouraged.

(d) Technological, agricultural, and financial literacy farmers

Low financial, technological and agricultural literacy represents a significant barrier to effective use of ICTs in risk management by farmers in Nigeria and other developing countries. Availability of trained agricultural extension agents would salvage the situation by educating the farmers.

2.3.4 ICT Applications for Mitigating Agricultural Risk

While agriculture will continue to be risky, many risks can be mitigated by timely action and through the application of best practices. Typical risk mitigation actions might be spraying crops with the appropriate pesticides in response to an early warning of a nearby pest outbreak or optimally altering cropping patterns in response to news from commodity futures

markets. Information is the most critical requirement for effective risk mitigation, and farmers need a variety of information to make choices to manage risk. Two types of information are most important for risk mitigation:

- **Early warnings** about the likely occurrence of inclement weather, pest and disease outbreaks, and market price volatility.
- **Advisory information** to help farmers decide upon a course of action to manage production risks optimally or to respond to early warnings. The connection between agricultural advisory services and risk mitigation is an important one, because information alone is often not sufficient to manage risk.

For example, if a farmer knew that a banana disease was spreading nearby, he or she required help in choosing the right action to prevent infection of the plants they owned. In many cases, the early warning or decision support information already exists. State meteorological services generally collect weather information and create forecasts. Similarly, agricultural institutes, research universities, or extension services are typically well aware of best practices in crop selection, production techniques, input use, pest management, global commodity trends, and other topics critical to smallholder farmers.

One difficulty has been to collect and process this information so that it is relevant to individual farmers. Another has been to transmit the information to rural populations in poorly connected areas in cost effective ways. ICT applications have made it easier and cheaper to achieve these objectives. There is some doubt about whether an early warning alone can help farmers mitigate risk. Many of these causal links have not been tested empirically. Latent demand for advice in addition to warnings appears to exist, but it is not clear whether farmers are willing to pay for such advice delivered using ICTs or whether the private sector can deliver such information sustainably.

2.3.4.1 ICT Applications for Mitigating Agricultural Risk

ICTs have reduced the costs of gathering, processing, and disseminating information that helps farmers mitigate risk. Information services using mobile phones and radios can direct early warnings of inclement weather, market movements, and pest and disease outbreaks to farmers. With an early warning, steps can be taken to limit potential losses. Farmers can also access advisory services remotely to support their decisions related to risk-mitigating activities or to choose the most appropriate action in response to an early warning. These decision support systems are critical for transforming information into risk mitigating action.

2.3.4.2 ICT Applications to Transfer Agricultural Risk

Applications of ICTs to transfer agricultural risk through instruments such as insurance and futures contracts are still quite limited. The widespread use of these instruments seems to be hampered by low levels of institutional development, high costs, inability to customize products to meet smallholders' requirements, and poor financial literacy rather than by the information constraints that ICTs can address. In a few instances, ICT applications are facilitating the design and delivery of index insurance. Although ICTs have made it easier for smallholders to access and participate in spot commodity exchanges, their use of ICT to participate in futures contracts to hedge price risks remains a distant dream.

2.3.4.3 ICT Applications for Coping with Agricultural Risk

While there have been few applications of ICTs to cope with agricultural shocks, those that exist are proving important and potentially transformative. Mobile phones enable ground personnel or affected persons to report more easily to whoever is coordinating a response to the shock. This communication leads to better-targeted relief efforts. In the event of a shock, ICTs facilitate transfers and remittances to farmers from state and relief agencies as well as from farmers' extended social networks. Finally, disaster management is using more sophisticated applications to collect and synthesize information from the field. In the future, these disaster management applications might be applied to respond to agricultural shocks.

2.3.5 Recent ICT Applications for Risk mitigation

Farmers in many countries receive news of impending bad weather and catastrophic events, pest and disease outbreaks, and price volatility in commodity markets. The use of ICTs has reduced the cost and increased the profitability of providing this information, which has attracted private sector participation in a space traditionally dominated by state extension services or agricultural institutes. The private sector originally developed services to provide market price information, but most of these services have evolved to deliver news about impending catastrophic and inclement weather.

2.3.5.1 ICTs and Risk Management: Emerging Issues

The use of ICTs for risk mitigation is an emerging simpler way of communicating information to farmers. A number of insights emerge from recent experiences in using ICTs to mitigate agricultural risk.

1. One important insight is that the missing link in providing risk mitigating information to farmers was not the information itself but the challenge of aggregating, personalising, and disseminating it in a timely and cost-effective way. The content that farmers need is already produced by universities and agricultural research institutes.
2. Any use of ICT applications to mitigate agricultural risk must ensure that the fundamental requirements described above are present or can be developed easily. For example, farmers' familiarity with ICTs should be assessed before initiating an intervention. Similarly, there should be a baseline understanding of whether farmers have the capacity to make good use of the information. Do farmers have access to rural finance, markets, transport, technology, inputs, and so on? If not, consider awareness and education programs regarding risk-mitigating strategies or appropriate responses to early warnings.
3. One difficulty in providing early warning or advisory services to farmers was not that the information was lacking, but that it could not be delivered effectively. ICTs make it easier to collect information from the universities and institutes that produce it and then to personalise it and provide it directly to farmers. The medium matters, however. A radio announcement is different from a phone call, which is again different from a text message. Collaboration between the private and public sector is increasing.
4. The public sector generates early warnings and provides expert advice, while the private sector has found that it can leverage ICTs (particularly mobile phones and back-end data collection and processing systems) to deliver this content to farmers quickly. Profitability remains a challenge. In many instances, the upfront investment and capital costs (such as the cost of investing in weather and ICT infrastructure) as well as the operational costs are high. A longer-term horizon and significant economies of scales are required to break even.
5. The ability to deliver highly personalised information is another key to earning revenue. Farmers naturally want information relevant to themselves—their crops, their plant and livestock disease, their markets—in the language they speak.
6. It is difficult to elicit direct payment for services from farmers, but if farmers see a value proposition, they are often willing to pay for a service. As a result, private participation in delivering information should be encouraged where possible, but the commercial sustainability of such initiatives should be analysed rigorously.
7. Information service providers should be encouraged to partner with the public sector to source content.

Self-Assessment Exercise

1: Describe how service cost affect ICTs in Risk Management.
2. Describe the basic requirements for application of ICTs in risk management**.**

2.4 Conclusion

In this unit, you have learnt about the use of ICTs in risk management. ICTs can be used for risk mitigation, risk transfer and risk coping.

2.5 Summary

In this unit, we have considered the central role of information in risk management; challenges and enabler of ICTs in risk management and ICTs and risk mitigation as well as emerging issues from application of ICTs in risk management.

2.6 References/Further Reading/Web Sources

Banerjee, D. (2010). 'Mobile-Phone Farming'. *The Wall Street Journal*, August 24, 2010. Retrieve from http://bit.ly/cB2Ofn, September, 2010.

World Bank. (2007). *Agriculture for Development*. World Development Report 2008. Washington, DC.

2.7 Possible Answers to Self-Assessment Exercises

1: Describe how service cost affect ICTs in Risk Management

Service Cost: The first key challenge and enablers of ICTs in risk management, cost of risk management services, particularly information services, customised to their needs. However, before adequate customisation occurs, most risk management services need public or private funding to support farmers' initial access. Thus, partnerships are central to assembling the combination of knowledge, skills, and resources required to manage risk through the use of ICTs. Successful efforts display cooperation between software developers, hardware manufacturers, agricultural experts, financial intermediaries, state governments and institutions, donors, nongovernmental organisations (NGOs), mobile operators, and others in the private sector.

These partners might have different incentives for participation that may not always be compatible, and different stakeholders may have different

time horizons. To hold such partnerships together, an appropriate balance must be struck between stakeholders' competing interests and short- and long-term gains. Because partnerships, particularly with the participation of the private sector, are so vital in risk management, an enabling policy environment and institutional framework supporting business and entrepreneurship is a critical incentive for private investment to cope with or transfer risk. Additional fundamental elements are adequate physical and telecommunications infrastructure for the cost-effective deployment of ICTs. Where costs are sufficiently low because mobile infrastructure is already available, more profitable opportunities may exist.

2. Basic requirements for application of ICTs in risk management are:

Successful application of ICTs in risk management in agriculture requires that certain basic requirements must be fulfilled. These requirements/facilities are external support from government, nongovernmental organisations and private establishments. The requirements/facilities are listed below.

(a) Infrastructure

Basic facilities that are required for the take-off of application of ICTs in risk management are uninterrupted electricity delivery and mobile network coverage. The importance of electricity in ICTs usage cannot be overemphasized. Even if mobile network coverage is achieved in all the nooks and crannies of Nigeria, epileptic nature of electricity supply will hinder the delivery of information as at when due.

(b) Institutional and regulatory reform

There should be the reformation of traditional institutions and cultural background that can serve as a barrier to the adoption of ICTs for risk management.

(c) Business climate reforms

The business climate must be reformed in such a way that participation and innovation from the private sector in the utilisation of ICTs in agricultural risk management will be encouraged.

(d) Technological, agricultural, and financial literacy farmers

Low financial, technological and agricultural literacy represents a significant barrier to effective use of ICTs in risk management by farmers in Nigeria and other developing countries. Availability of trained agricultural extension agents would salvage the situation by educating the farmers.