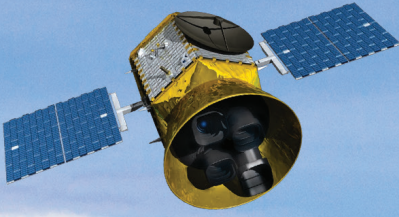


VEGETATION INDEX CROP INSURANCE TRAINERS MANUAL



PFEA

Ethiopian **ATA**
Agricultural Transformation Agency



kifiya

NMA



UNIVERSITY OF TWENTE.

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Introduction

The Ethiopian agriculture sector which employs 80-85% of the labor force in the country is highly susceptible to changes in the climate as it is highly dependent in rainfall. It is a recent news that the country is facing the worse drought seen in the last decades that puts millions at risk. However, there are no mechanized and formalized means to reduce the effect of drought in the country which results in the initiation of this project. The plan is to introduce a risk management tool by transferring certain risk to insurance companies so that farmers don't have to fall in the circle of poverty.

The project is launched with public private partnership initiatives between Public Finance Enterprises Agency (PFEA), Agricultural transformation agency (ATA), Ethiopian insurance corporation (EIC), National Metrology Agency (NMA), ITC university of Twente, and kifiya financial technology. The initiative aims in launching the vegetation index crop insurance product in four regions of Ethiopia namely Amhara, Tigray, Oromia and SNNP. The insurance product is believed to help farmers to cope up with the negative effects of drought by insuring their credit or a fixed monetary amount. Claims are paid by a predefined trigger and exit thresholds that are calculated with in a grid -level (1 km² pixel level).

Learning objectives

- To define and explain risk and risk management
- To define what microinsurance and its advantages
- To distinguish the basic nature of microinsurance from the conventional insurance product
- To understand the features of VICI (vegetation index crop insurance)
- To learn about the product logistics



Session one: Risk and Risk Management

Session objectives:

After completing this session trainees should understand the following concepts

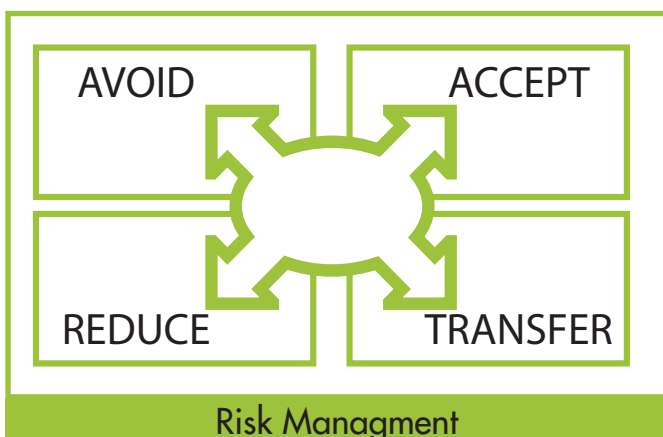
- i) Describe the concept of risk and risk management
- ii) Explain what insurance is.
- iii) List & explain the principles of insurance.

i. Risk and Risk Management

Risk is:- A probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through preemptive action.

Risk management is the process of determining the maximum acceptable level of overall risk to and from a proposed activity then using risk assessment techniques to determine the initial level of risk and developing a strategy to reduce the overall level of risk to an acceptable level.

It is an identification, analysis, assessment, control, and avoidance, minimization, or elimination of unacceptable risks. An organization may use risk assumption, risk avoidance, risk retention, risk transfer, or any other strategy (or combination of strategies) in proper management of future events.



ii. Insurance

Insurance is a form of risk management primarily used to hedge against the risk of a contingent, uncertain loss. Insurance is defined as the equitable transfer of the risk of a loss, from one entity to another, in exchange for payment. Those who buy insurance always transfer a proportion of their insured risks to the insurance company in return for payment of an insurance premium which is the periodic payment/the actual amount of money charged on an insurance contract (policy). An insurer is a company selling the insurance. The insured, or policyholder, is the person or entity buying the insurance policy. The amount to be charged for a certain amount of insurance coverage is called the premium. Contract of Insurance Is a contract whereby the insurer undertakes to make good the loss of another called the insured by payment of some money to him on the happening of a specific event. Formal insurance works this way, people who buy insurance pool their resources by contributing to an insurance fund. The fund is used to cover the cost of those who suffer the loss; however, the insured is expected to bear a defined proportion of the insured risk. Individual risks are consequently reduced by spreading them among the fund contributors. Therefore, insurance not only involves **risk transfer** but also **pooling and risk reduction**. Thus the risk for the group is reduced and the losses that result are pooled through the payment of an insurance premium (the price for insurance cover).

Criteria of determination of whether a risk can be insured or not

- The risk must arise out of the ordinary course of business and it should not be artificially created by parties.
- The risk must be common enough to justify its spreading at a nominal cost.
- There must be an element of uncertainty as to the occurrence of risk or the time of the occurrence.
- The party must have some real interest in avoiding the risk.

Seven most important Principles of Insurance

1. Nature of contract:

Nature of contract is a fundamental principle of insurance contract. An insurance contract comes into existence when one party makes an offer or proposal of a contract and the other party accepts the proposal. A contract should be simple to be a valid contract. The person entering into a contract should enter with his free consent.

2. Principle of utmost good faith:

Under this insurance contract both the parties should have faith over each other. As a client it is the duty of the insured to disclose all the facts to the insurance company. Any fraud or misrepresentation of facts can result into cancellation of the contract.

3. Principle of Insurable interest:

Under this principle of insurance, the insured must have interest in the subject matter of the insurance. Absence of insurance makes the contract null and void. If there is no insurable interest, an insurance company will not issue a policy.

An insurable interest must exist at the time of the purchase of the insurance. For example, a creditor has an insurable interest in the life of a debtor, a person is considered to have an unlimited interest in the life of their spouse etc.

4. Principle of indemnity:

Indemnity means security or compensation against loss or damage. The principle of indemnity is such principle of insurance stating that an insured may not be compensated by the insurance company in an amount exceeding the insured's economic loss. In type of insurance the insured would be compensation with the amount equivalent to the actual loss and not the amount exceeding the loss. This is a regulatory principle. This principle is observed more strictly in property insurance than in life insurance. The purpose of

this principle is to set back the insured to the same financial position that existed before the loss or damage occurred.

5. Principle of Subrogation:

The principle of subrogation enables the insured to claim the amount from the third party responsible for the loss. It allows the insurer to pursue legal methods to recover the amount of loss, for example, if you get injured in a road accident, due to reckless driving of a third party, the insurance company will compensate your loss and will also sue the third party to recover the money paid as claim.

6. Double Insurance:

Double insurance denotes insurance of same subject matter with two different companies or with the same company under two different policies. Insurance is possible in case of indemnity contract like fire, marine and property insurance. Double insurance policy is adopted where the financial position of the insurer is doubtful. The insured cannot recover more than the actual loss and cannot claim the whole amount from both the insurers.

7. Principle of proximate cause:

Proximate cause literally means the 'nearest cause' or 'direct cause'. This principle is applicable when the loss is the result of two or more causes. The proximate cause means; the most dominant and most effective cause of loss is considered. This principle is applicable when there are series of causes of damage or loss.

Session Evaluation

Evaluate whether the session objectives have been met by asking your trainees the following questions

- i. How do you define risk?
- ii. What are the risks farmers faces around your area? Discuss
- iii. What is the difference between insurance & traditional risk mitigation mechanisms?

Session two:

Micro insurance

Session objectives: After completing this session trainees should understand the following concepts

- i) Describe what microinsurance means.
- ii) Explain the importance of microinsurance and how it helps farmers.
- iii) Distinguish between microinsurance and conventional insurance products.

i. What is Microinsurance

Micro insurance is the protection of **low-income** people against specific perils in exchange for regular premium payments proportionate to the likelihood and cost of the risk involved" Draft Donor Guidelines, CGAP Working Group (2003)

Micro insurance "...is a mechanism to protect **poor people** against risk (accident, illness, death in the family, natural disasters, etc.) in exchange for insurance premium payments **tailored to their needs, income and level of risk**. It is aimed primarily at the developing world's **low-income** workers, especially those in the informal economy who tend to be underserved by mainstream commercial and social insurance schemes." ILO, Micro insurance Innovation Center (2008)

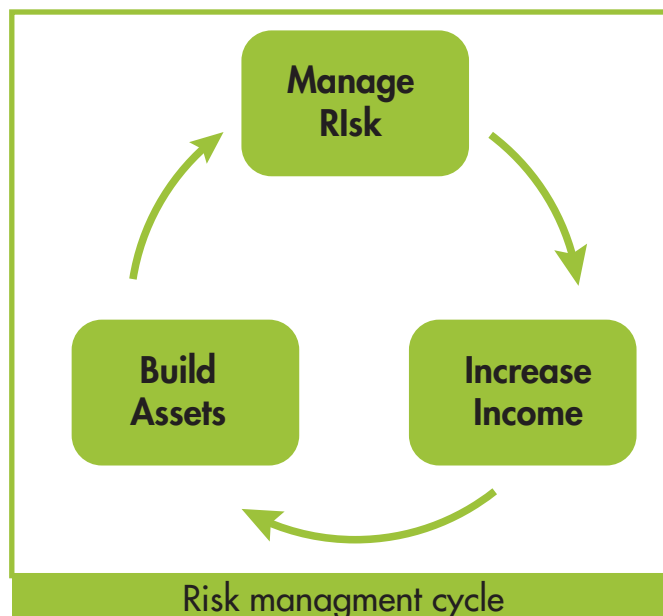
- There are many types of microinsurance products for example crop insurance, livestock insurance, credit life insurance, Health life insurance etc.

ii. Why is micro insurance important?

- **Financial Inclusion:** One of several risk management tools to protect the most vulnerable populations and help them retain the assets they work so hard to build.
- **Social Protection:** Complement or substitute for government protection mechanisms such as health insurance and pensions for low income workers.
- **Commercial:** New markets for commercial sector which has relatively low penetration worldwide and needs to expand to grow.
- **Macroeconomic:** Insurance is a vital precondition for economic development, as it provides a reliable mechanism for individuals, institutions and governments to assume risks.

Micro insurance is...

A Risk Management Tool for Low-Income People



Potential impact from threats

- Reallocated household resources
E.g. pulling children out of school
- Depletion of assets &/or savings
- Indebtedness
- Loss of income
- Exclusion from financial Markets

iii. Key Differences Between Micro and Conventional Insurance products

Conventional insurance products

- Complex policy document
- Limited eligibility with standard exclusion
- Regular premium payments as banking transaction
- Usually minimum of twelve months
- Small and large sum insured
- Priced based on age/specific risk
- Market is largely familiar with insurance

Microinsurance products

- Simple, easy to understand policy document
- Broadly inclusive, with few if any exclusions
- Premiums accommodate customers' irregular cash flows, paid in cash or with another financial transaction
- Period of coverage can be as short as 4 months
- Only small sums insured
- Community or group pricing
- Distribution channel may manage

Session Evaluation

Evaluate whether the session objectives have been met by asking your trainees the following questions

- i. How do you define micro insurance?
- ii. What are the importance of micro insurance? Discuss



Session three: Vegetation

Index Crop Insurance

Session objectives: After completing this session trainees should understand the following concepts

- i. Explain index based insurance and its difference with conventional insurance
- ii. Explain what VICI is and how the index is constructed
- iii. What risk is covered under VICI product
- iv. Explain the payout function
- v. Explain the trigger point and its significance
- vi. Explain the exit point and its significance

i. Index based insurance

Index based insurance uses a suitable and measurable proxy such as forage availability or rainfall to construct an indicator or **index** that is highly associated with event being insured (drought related livestock deaths or crop failure respectively). Index insurance establishes a defined limit of range of values over which compensations can be made. The limit often marks the point at which payments begin.

For example, an index insurance contract designed to cover the risk of drought related livestock mortality would begin making indemnity payments if forage availability fell below a certain threshold over a defined time period, such as a year. Index insurance is best suited for **correlated risks** (severe, widespread events such as droughts).

Conventional insurance	Index based insurance
Suitable for independent (uncorrelated) risk such as a car accident	Suitable for correlate (widespread) risk such as drought
Compensation done on actual losses. The actual losses have to be assessed by claim assessors before payout is made	Compensation is based on the index reading for a locality such as the forage availability index for woreda or any geographical unit
Payout process is long, cumbersome and subject to bias	Objective triggers & structured rules exist. When they occur payment is automatically done
Claim is slower	Claim is faster
Payment made to individuals according to verified individual loss	Payment made to all individuals within a coverage area as per the index level.

The difference between conventional and index based insurance

ii. Vegetation index crop insurance (VICI)

NDVI:- Normalized Difference Vegetation Index (NDVI) is a long standing index used by national and international agencies to monitor the occurrence of drought. The index reflects the amount of active chlorophyll in the vegetation present in the geographical area observed. It is a simple graphical indicator that can be used to analyze remote sensing measurements, typically but not necessarily from a space platform, and assess whether the target being observed contains live green vegetation or not. NDVI is an output based index and measures the current state of green vegetation i.e. it is a measure of the impact on vegetation of weather inputs like rainfall, wind, heat etc.

a. The Source of NDVI Data

The source of NDVI data used in the model is from the National Meteorological Agency (NMA) of Ethiopia. Kifiya, through the GIA-CIS project has invested in a system called GeoNetCast installed at NMA that provides

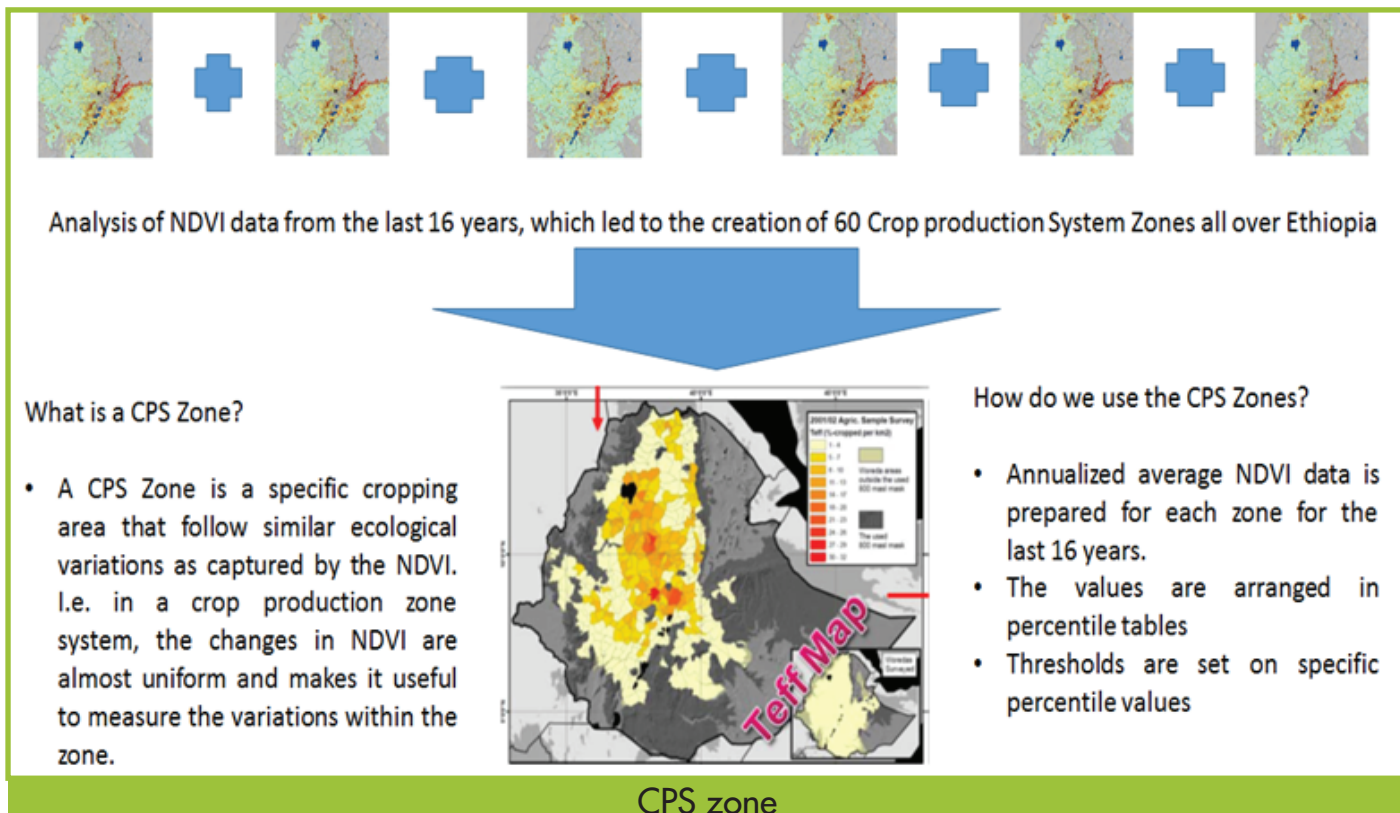


i. Setting up CPS Zones

The researchers of the product, have looked at the historical NDVI data from the last 16 years, measuring variations in vegetation all over Ethiopia. This has led to the setting up of Crop Production System (CPS) Zones. Simply put, a CPS Zone is a homogenous area as per NDVI data, i.e. all across the CPS Zone the variations in NDVI across 16 years have been homogenous, leading to the inference that this particular area has a set crop growing pattern, reflected via NDVI.

Each CPS zone has been defined on long-duration NDVI values that reflect by relatively similar agro-climatology (climate, terrain, altitude, soil, etc.) along with its long-duration impact on the land cover mainly natural vegetation & crops. The short-duration impacts of weather on the zoning effort is notably absent. The zoning has been done based on long term climatic and other factors. The following figure describes the process:

Setting the CPS Zones - using Historical data



ii. Growing Seasons

For each CPS zone, a growing season has been defined. A growing season is that period of the calendar year which is suitable for growing crops based on the historical NVDI data analysis.

Each year has been divided into 10 day periods. i.e. a year of 365 days has been divided into 36 10 day period. Based on the historical data analysis, for each CPS Zone the growing season has been defined as those 10 day period during which crops can be grown in that

particular zone. Hence, the period of insurance for VICI in a particular zone will only be this range of growing season.

Growing season's logic is implemented through a table in which CPS zones are numbered as rows, and 36 10-day periods are numbered as columns. A value "1" against any column indicates that 10-day period falls within growing season and a value "0" under any column indicates that 10-day period is not part of the growing season.

Default Growing Seasons				important zones				Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov
CPS-Zone	Seaso	Seaso	Leagl	Valid	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
52	Main	1	11	Y	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0		
38	Early	1	10	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
55	Main	1	10	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
39	Early	1	9	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
46	Early	1	9	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
50	Early	1	9	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
19	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
24	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
27	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
28	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
35	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
37	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
45	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
34	Early	1	7	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
40	Early	1	7	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
13	Early	1	6	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
20	Early	1	6	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
29	Main	1	21	Y	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
43	Main	1	21	Y	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
54	Main	1	20	Y	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0		
59	Early	1	10	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
51	Early	1	9	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
60	Early	1	9	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
17	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
41	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
58	Early	1	8	Y	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12	Early	1	7	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
33	Early	1	6	Y	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
36	Early	1	20	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
48	Main	1	20	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0		
57	Main	1	20	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0		
44	Main	1	19	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0		
49	Main	1	18	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0		
31	Early	1	7	Y	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
53	Early	1	7	Y	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	Main	1	18	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	
26	Main	1	18	Y	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	
21	Main	1	16	Y	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	
32	Main	1	16	Y	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	
16	Main	1	15	Y	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	
10	Main	1	11	Y	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	
7	Main	1	10	Y	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	
18	Main	1	12	Y	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	

Growing season table



iii. Setting Thresholds - Benchmark NDVI Values:

Using 16-year historical data, Average NDVI values have been calculated and stored for each CPS zone for each of the 36 10 day periods of a year.

A **percentile** is a measure used in statistics indicating the value below which a given percentage of observations in a group of observations fall. For example, the 20th **percentile** is the value (or score) below which 20 percent of the observations may be found.

The Historical NDVI data for each zone has been arranged as per percentiles. This means that all historical data of each zone has been organized in percentiles from a minimum value observed (0% percentile) to the maximum value of NDVI data observed (100% Percentile). So when we say that an NDVI data observation is in the 15% (15th percentile) it means that this value falls within the 15% of the lowest NDVI data values observed in that region.

So if the 15% is set to be the trigger point, it means that the NDVI index declares the vegetation difference in that particular land grid where the NDVI data value that comes in falls in the lowest 15% of all NDVI data values observed for that period in the last 16 years.

Similarly, Exit value of a percentile is said to be the value at which the NDVI index declares the vegetation difference to be a 100% effective. So if the exit threshold is defined to be 5%, it means that the NDVI value that comes in is lower than the lowest 5% of all NDVI data values observed for the period in the last 16 years.



Analysis of NDVI data from the last 16 years, which led to the creation of 60 Crop production System Zones all over Ethiopia

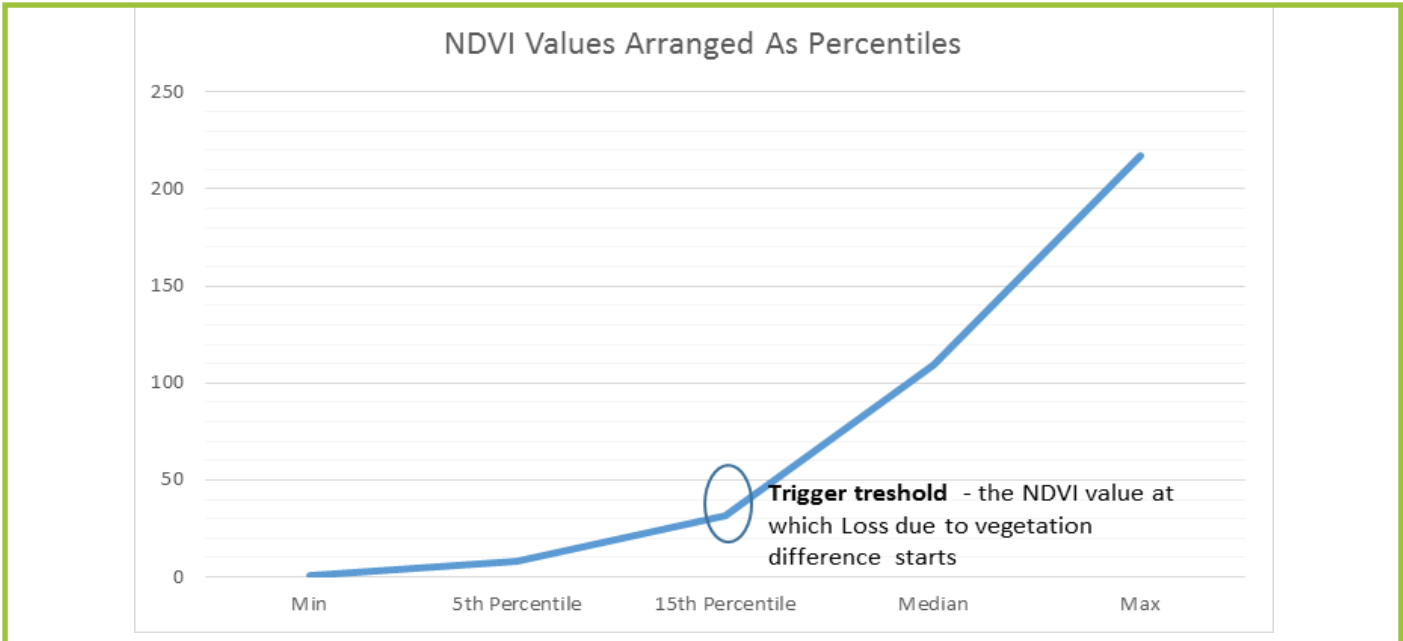
- For each zone, average values of NDVI data observed over 16 years in 10 day periods are entered into the benchmark NDVI table
- The NDVI data are arranged in percentiles



Benchmark NDVI data Table

Percentiles	CPS_Zone	Period_17	Period_18	Period_19	Period_20	Period_21	Period_22	Period_23	Period_24	Period_25	Period_26	Period_27	Period_28	Period_29	Period_30	Period_31	Period_32	Period_33	Period_34	Period_35	Period_36
6	8	49.9	48.6	49.0	51.5	55.9	60.5	64.8	67.9	69.7	69.9	69.3	68.1	66.6	65.6	64.4	63.5	62.5	61.7	60.5	59.7
7	8	50.3	48.8	49.3	52.0	56.3	61.3	65.7	68.9	70.3	70.7	69.8	68.5	67.4	65.9	64.7	63.7	62.9	62.1	61.2	60.2
8	8	50.6	49.3	49.7	52.1	56.8	61.5	66.3	69.5	71.1	71.4	70.3	69.3	67.7	66.5	65.4	64.3	63.4	62.3	61.5	60.7
9	8	50.7	49.5	49.9	52.3	57.1	62.3	66.8	70.1	71.8	71.9	71.1	69.6	68.0	66.8	65.5	64.6	63.6	62.9	61.8	60.9
10	8	51.1	49.7	50.1	52.9	57.6	62.7	67.5	70.9	72.5	72.5	71.3	69.9	68.6	67.2	66.0	64.9	64.1	63.1	62.2	61.3
11	8	51.5	50.1	50.5	53.2	57.9	63.1	68.0	71.5	72.9	73.1	72.0	70.6	68.9	67.9	66.3	65.2	64.4	63.4	62.5	61.8
12	8	51.7	50.3	50.7	53.3	58.1	63.5	68.4	72.1	73.7	73.5	72.3	70.7	69.3	67.9	66.6	65.7	64.5	63.7	62.9	61.8
13	8	51.7	50.4	50.9	53.6	58.5	63.8	68.9	72.6	74.1	74.2	72.8	71.2	69.7	68.2	66.9	65.9	64.9	64.1	62.9	62.2
14	8	52.0	50.8	51.1	53.8	58.7	64.5	69.4	73.0	74.7	74.5	73.1	71.6	69.9	68.7	67.2	66.2	65.3	64.3	63.4	62.5
15	8	52.2	50.9	51.2	54.1	59.0	64.5	69.9	73.7	75.1	75.1	73.7	71.9	70.3	68.8	67.5	66.4	65.5	64.5	63.7	62.8
16	8	52.6	51.1	51.7	54.5	59.3	64.9	70.4	74.0	75.7	75.3	73.9	72.3	70.6	69.1	67.8	66.7	65.7	64.8	63.8	62.9
17	8	52.7	51.1	51.7	54.5	59.7	65.3	70.8	74.7	76.1	75.9	74.4	72.6	71.0	69.5	68.1	66.9	65.9	65.1	64.1	63.3
18	8	52.8	51.4	51.8	54.7	59.8	65.5	71.1	75.0	76.5	76.3	74.7	72.9	71.3	69.8	68.2	67.2	66.3	65.3	64.3	63.5
19	8	52.9	51.6	51.9	54.9	60.0	66.1	71.5	75.3	77.1	76.6	75.2	73.3	71.4	69.9	68.7	67.5	66.6	65.4	64.5	63.7
20	8	53.2	51.9	52.1	55.2	60.5	66.3	71.8	75.6	77.5	77.1	75.5	73.5	71.7	70.2	68.8	67.7	66.7	65.8	64.9	63.9
25	8	54.0	52.5	53.1	55.9	61.4	67.7	73.7	77.7	79.3	78.7	77.0	74.9	73.1	71.5	70.1	68.8	68.0	66.7	65.9	64.9
50	8	57.9	56.2	56.7	60.3	66.4	74.3	81.6	86.6	88.3	86.9	84.0	81.4	79.1	77.3	75.5	74.3	73.1	71.9	71.0	70.1
1	9	57.7	55.5	53.3	51.7	51.3	51.9	52.6	53.3	54.1	54.9	55.9	57.7	59.7	61.7	62.6	62.8	62.9	62.0	61.2	60.3
2	9	59.2	56.8	54.4	52.9	52.3	52.5	53.3	53.9	54.8	55.7	57.1	58.9	60.8	62.7	63.9	64.0	63.9	63.0	62.2	61.4
3	9	60.1	57.5	55.1	53.7	52.9	53.1	53.8	54.4	55.4	56.2	57.7	59.4	61.5	63.5	64.6	64.9	64.7	64.1	63.0	62.1
4	9	60.5	58.1	55.6	53.9	53.5	53.6	54.1	54.7	55.7	56.6	58.0	59.8	62.1	64.2	65.3	65.5	65.2	64.6	63.6	62.6
5	9	61.3	58.7	56.3	54.4	53.6	53.8	54.3	55.1	55.8	56.9	58.3	60.3	62.6	64.6	65.7	66.0	65.7	65.1	64.0	63.1
6	9	61.7	58.9	56.6	54.9	54.1	54.1	54.6	55.3	56.3	57.0	58.7	60.7	62.9	65.1	66.3	66.4	66.2	65.5	64.4	63.5
7	9	61.9	59.4	56.9	55.2	54.5	54.4	54.8	55.5	56.4	57.3	58.9	60.9	63.5	65.6	66.7	66.9	66.7	66.0	64.9	63.7
8	9	62.3	59.7	56.9	55.5	54.7	54.5	55.2	55.6	56.5	57.7	59.4	61.3	63.8	65.9	67.1	67.1	67.1	66.1	65.2	64.3
9	9	62.7	59.9	57.5	55.8	54.8	54.7	55.2	55.9	56.7	58.1	59.4	61.6	63.9	66.2	67.4	67.7	67.5	66.5	65.5	64.3
10	9	63.0	60.3	57.8	56.0	55.0	55.0	55.3	56.0	56.9	58.1	59.6	61.7	64.3	66.5	67.7	68.1	67.7	66.9	65.7	64.6
11	9	63.2	60.5	58.0	56.1	55.2	55.2	55.6	56.2	57.2	58.1	59.8	62.1	64.7	66.9	68.2	68.3	68.0	67.2	66.0	64.8

Analysis of 16 years historical data



Sample representation of percentiles

c. Product Design Description

i. Risk pricing and setting of thresholds

The VICI product is designed to be offered at pure risk premiums ranging from 5 % to 19.5 % of the sum insured. It is up to the Ethiopian Insurance Corporation (EIC) based on the rate of reinsurance to decide what rate of pure risk premium, i.e. Estimated Cost of Loss (ECL). Please note that this is the pure risk premium, EIC will have to add a loading on this rate to cover its operational costs.

Each ELC % offers a range of percentile values to be selected by EIC as the trigger and exit thresholds for the product. Following is the snapshot of the table

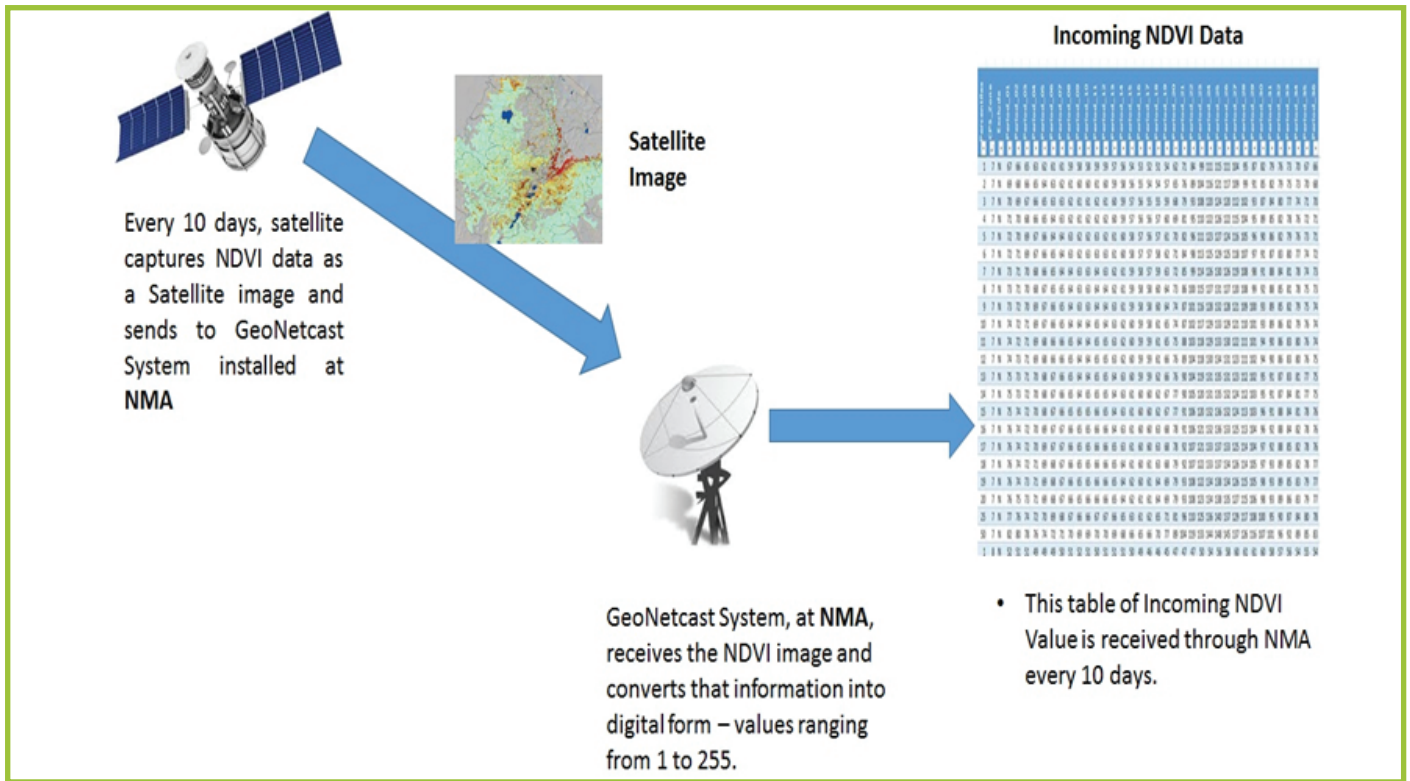
Policy	Trigge	Exit	ELC	Duration
Policy_119	17	1	9,0	11,1
Policy_120	16	2	9,0	11,1
Policy_121	15	3	9,0	11,1
Policy_122	14	4	9,0	11,1
Policy_123	13	5	9,0	11,1
Policy_124	12	6	9,0	11,1
Policy_125	11	7	9,0	11,1
Policy_126	10	8	9,0	11,1
Policy_110	18	1	9,5	10,5
Policy_111	17	2	9,5	10,5
Policy_112	16	3	9,5	10,5
Policy_113	15	4	9,5	10,5
Policy_114	14	5	9,5	10,5
Policy_115	13	6	9,5	10,5
Policy_116	12	7	9,5	10,5
Policy_117	11	8	9,5	10,5
Policy_118	10	9	9,5	10,5
Policy_101	19	1	10,0	10,0

VICI table

For instance, if EIC chooses the ELC (risk premium) at 9% of the sum insured, EIC can choose from the given combination of percentiles to fix the trigger and exit percentiles that will be applicable all over Ethiopia, for every Crop Production System zone. This enables the comparison of latest NDVI data that comes in with the historical thresholds set in the benchmark tables

ii. How the product works
Incoming NDVI data

During the course of a specific year NDVI Values will be provided by National Meteorological Agency (NMA) at every 10-day period interval, these are called "Incoming NDVI Values". Incoming NDVI Values are provided at a more granular level, i.e. at the level of 1km² called as Grid level. The country of Ethiopia has been divided into 1km² grids and given specific grid IDs called Grid codes (Figure 1) and each Grid code is mapped to a particular CPS zone. Crop insurance policies are sold to the farmers at **Grid level**. Therefore, the incoming NDVI Values at each grid level are used to calculate the claims against benchmark NDVI Values for each individual policy holder (farmer).

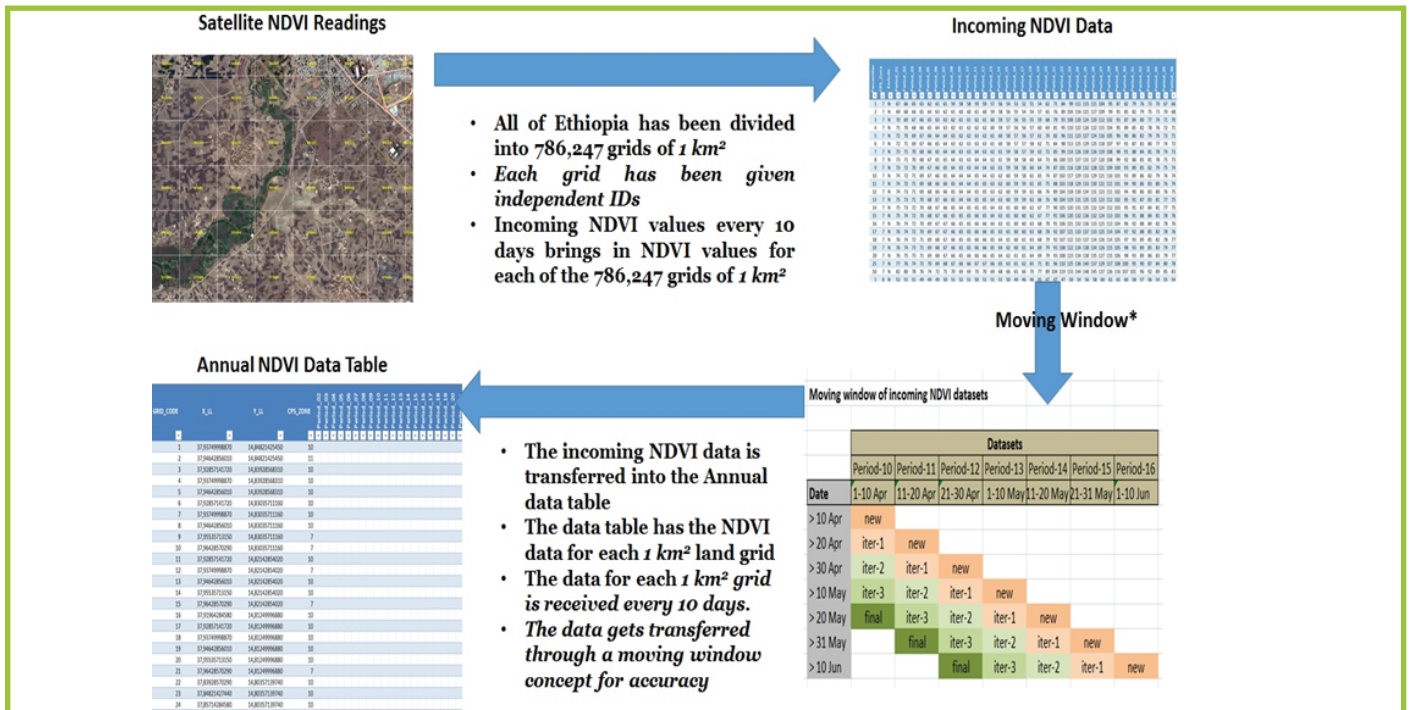


Incoming NDVI Values

NDVI data annual table

This table is created to record the incoming NDVI values received from National Meteorological Agency. It must be updated for every Grid Code after every 10-day period of

the year. The Incoming NDVI-data is received from NMA via FTP into the Kifiya Micro-insurance platform (immediately after each 10-day period). The data reflects NDVI-values (DN-format; 0-225 integers), recorded at the 1 km² grid level



Process from Satellite NDVI reading to annual NDVI data table

Moving window note:

when a new 10-day NDVI dataset arrives at the microinsurance technology platform, it contains updated values of the 4 earlier 10-day datasets too (consequence of the used de-clouding algorithms in use at NMA). So effectively, each 10-days, 5 10-day NDVI datasets must be updated in the Annual Data Table. A 10-day dataset gets better-and-better after each iteration (after the 4th iteration it is the final 10-day dataset). Effectively that means that 40-50 days are required after the date that the period covered by a policy is passed, to financially fully close that policy.

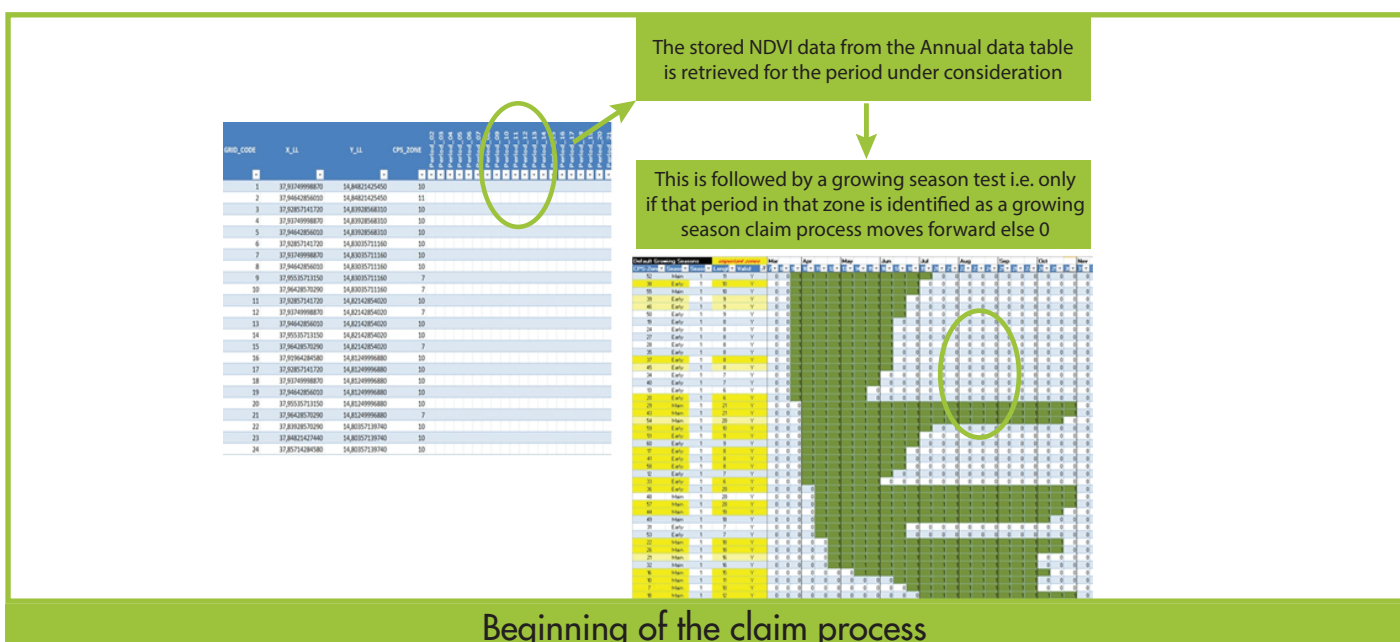
iv. Claims calculations

A unique feature of the VICI, like any other index insurance, is that the claims are triggered automatically, if the set thresholds are breached. For each policy sold, i.e. for a land grid id insured, a claims table will be created during the growing season and the following steps will be followed for every 10-day period:

The steps to be followed are:

- For each Grid Code, incoming NDVI value stored in the Annual Data Table is retrieved.
- CPS zone in which grid code lies is retrieved.
- Growing season check

These three steps are depicted as below:



- After the above three steps,
- Trigger and Exit benchmarks of Policy ID whose claims are being calculated are retrieved from Policy Data Table.
 - Benchmark NDVI values corresponding to the trigger and exit percentiles and CPS Zone are retrieved from the Benchmark NDVI Table.
 - Benchmark NDVI Value are compared against the Incoming NDVI Value and claim calculation is done

These three steps are depicted on the next page:

ELC and Trigger and Exit Combination

Policy	Trigger	Exit	ELC	Duration
Policy_119	16	2	9,0	11,1
Policy_120	16	2	9,0	11,1
Policy_121	15	3	9,0	11,1
Policy_122	14	4	9,0	11,1
Policy_123	13	5	9,0	11,1
Policy_124	12	6	9,0	11,1
Policy_125	11	7	9,0	11,1
Policy_126	10	8	9,0	11,1
Policy_110	18	1	9,5	10,5
Policy_111	17	2	9,5	10,5
Policy_112	16	3	9,5	10,5
Policy_113	15	4	9,5	10,5
Policy_114	14	5	9,5	10,5
Policy_115	13	6	9,5	10,5
Policy_116	12	7	9,5	10,5
Policy_117	11	8	9,5	10,5
Policy_118	10	9	9,5	10,5
Policy_101	19	1	10,0	10,0

The set Trigger and exit percentiles for the product are retrieved

The benchmark NDVI values corresponding to the percentiles set for the CPS zone for the period under consideration are retrieved

Benchmark NDVI Data Zone wise arranged as percentiles

Periods	CPS_Zone	Period_17	Period_18	Period_19	Period_20	Period_21	Period_22	Period_23	Period_24	Period_25	Period_26	Period_27	Period_28	Period_29	Period_30	Period_31	Period_32	Period_33	Period_34	Period_35	
6	8	89,9	48,6	49,0	51,5	55,9	65,5	64,8	67,9	67,7	69,9	69,3	68,1	66,6	65,6	64,4	63,7	62,5	61,7	60,5	59,7
7	8	36,3	48,8	49,3	52,0	56,3	63,3	63,7	65,9	70,7	70,7	69,8	68,5	67,4	65,9	64,7	63,7	62,9	62,1	61,2	60,2
8	8	30,6	49,1	49,7	52,1	56,8	63,5	66,3	69,7	74,7	74,7	73,1	69,3	67,7	66,5	65,4	64,3	63,4	62,5	61,5	60,7
9	8	36,7	49,5	49,9	52,3	57,1	63,3	66,8	70,1	75,7	75,7	73,1	69,6	68,0	66,8	65,5	64,6	63,6	62,9	61,9	60,9
10	8	41,1	49,7	50,1	52,9	57,6	63,3	67,4	70,9	76,4	76,4	73,8	69,8	68,6	67,2	66,0	64,9	64,1	63,1	62,2	61,3
11	8	51,4	49,7	50,3	53,2	57,9	63,1	66,8	70,5	75,9	75,9	73,1	70,0	70,6	69,4	67,9	67,2	66,2	65,2	64,3	63,2
12	8	51,7	50,3	50,7	53,3	58,3	63,5	66,4	72,1	73,7	73,7	70,3	67,3	66,6	65,7	64,5	63,7	62,7	61,8	60,8	59,8
13	8	51,7	50,4	50,9	53,6	58,5	63,8	66,9	72,6	74,2	74,2	71,2	71,2	69,7	68,2	66,9	65,9	64,9	64,1	63,2	62,2
14	8	52,0	50,8	51,1	53,8	58,7	64,5	68,4	73,7	74,5	74,5	71,1	71,1	70,0	68,7	67,2	66,2	65,3	64,3	63,4	62,4
15	8	52,2	50,9	51,2	54,1	59,0	64,5	68,9	73,7	75,1	75,1	71,7	71,7	70,3	68,8	67,5	66,4	65,5	64,5	63,5	62,5
16	8	52,2	51,0	51,7	54,5	59,3	64,9	70,4	74,2	75,7	75,7	71,9	71,9	70,6	69,1	67,8	66,7	65,7	64,7	63,7	62,7
17	8	52,7	51,2	51,9	54,7	59,5	65,1	69,4	74,2	75,9	75,9	72,1	72,1	70,8	69,2	67,9	66,8	65,8	64,8	63,8	62,8
18	8	52,8	51,4	52,1	54,7	59,8	65,5	71,1	75,0	76,5	76,5	72,9	72,9	71,5	69,8	68,2	67,2	66,3	65,3	64,3	63,3
19	8	52,9	51,6	52,3	54,9	60,0	66,1	71,5	75,3	77,1	77,1	73,4	73,4	71,8	69,9	68,2	67,2	66,3	65,3	64,3	63,3
20	8	53,2	51,9	52,1	55,2	60,5	66,3	71,8	75,6	77,5	77,5	73,5	73,5	71,7	70,2	68,8	67,7	66,7	65,8	64,8	63,8
25	8	54,0	52,5	53,1	55,9	61,4	67,7	73,7	77,7	79,3	79,3	75,0	75,0	73,1	71,5	70,1	68,8	67,7	66,7	65,8	64,8
50	8	57,9	56,2	56,7	60,3	66,4	73,3	81,6	86,6	89,3	89,3	84,0	84,0	81,4	79,3	77,5	76,3	75,1	73,9	72,8	71,6
1	9	57,7	55,5	56,1	59,7	65,9	72,9	80,3	84,1	84,9	84,9	80,0	80,0	77,7	75,7	74,7	73,6	72,5	71,4	70,3	69,2
2	9	59,2	56,8	57,4	60,9	67,3	74,5	81,9	85,8	85,7	85,7	80,4	80,4	78,0	76,0	74,9	73,8	72,7	71,6	70,5	69,4
3	9	60,1	57,5	58,1	61,7	68,1	75,3	82,8	86,4	86,2	86,2	80,8	80,8	78,4	76,3	75,2	74,1	73,0	71,9	70,8	69,7
4	9	60,5	58,1	58,6	62,3	68,7	75,9	83,4	86,7	86,5	86,5	81,0	81,0	78,5	76,4	75,3	74,2	73,1	72,0	70,9	69,8
5	9	61,3	58,7	59,3	63,0	69,4	76,6	84,1	87,3	87,1	87,1	81,5	81,5	78,9	76,8	75,7	74,6	73,5	72,4	71,3	70,2
6	9	61,7	59,0	59,6	63,3	69,7	76,9	84,3	87,5	87,3	87,3	81,7	81,7	79,1	77,0	75,9	74,8	73,7	72,6	71,5	70,4
7	9	61,9	59,4	60,0	63,7	70,1	77,3	84,7	87,9	87,7	87,7	82,1	82,1	79,5	77,4	76,3	75,2	74,1	73,0	71,9	70,8
8	9	61,9	59,7	60,3	64,0	70,4	77,6	85,0	88,2	88,0	88,0	82,4	82,4	79,8	77,7	76,6	75,5	74,4	73,3	72,2	71,1
9	9	62,7	59,9	60,5	64,2	70,6	77,8	85,2	88,4	88,2	88,2	82,6	82,6	80,0	77,9	76,8	75,7	74,6	73,5	72,4	71,3
10	9	63,0	60,3	60,9	64,6	71,0	78,2	85,6	88,8	88,6	88,6	83,0	83,0	80,4	78,3	77,2	76,1	75,0	73,9	72,8	71,7
11	9	63,5	60,5	61,1	64,8	71,2	78,4	85,8	89,0	88,8	88,8	83,2	83,2	80,6	78,5	77,4	76,3	75,2	74,1	73,0	71,9

Claim process continues

Hence, for a particular Policy ID, claim percentages is calculated for every grid code in Ethiopia. Claims thus calculated will be saved in a table created for each relevant policy and year (Policy Specific Claims table, figure as below). Hence, for each policy ID a claims table is created called "policy specific claims table". Aggregate claims due till now are up-

dated. The policy calculation sheet is as below followed by a box on claims calculation logic:

Benchmark NDVI Table		Percentiles	CPS_Zone	Exclude	Period_01	Period_02	Period_03	Period_04	Period_05	Period_06	Period_07	Period_08	Period_09	Period_10	Period_11	Period_12	Period_13	Period_14				
Exit:	5	29	N		102,9	98,6	94,6	91,2	88,4	86,1	84,9	84,9	86,7	89,9	94,4	100,1	106,1	111,4	116,1			
Trigger:	10	29	N		106,4	101,9	97,7	94,3	91,3	89,1	88,3	88,6	90,8	94,2	99,2	105,2	111,4	116,1	121,1			
Incoming NDVI data:												Period_08	Period_09	Period_10	Period_11	Period_12						
												70	90	95	96	94						
Growing Seasons table		CPS-Zo	Season	Seasor	Leng	Val	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
29	Main	1	21	Y			0	0	0	0	0	0	0	0	0	0	1	1	1	1		
Calculation steps:		Step-1: Assess if within season: no no yes yes yes																				
		If Yes then continu																				
		Step-2: Assess if incoming > trigger																				
		If Yes then enter 0																				
		Step-3: Else, assess if incoming < exit																				
		If Yes then enter 100																				
		Step-4: Else: apply formula:																				
		[1-(Incoming-Exit)/(Trigger-Exit)]*100																				
Result:		. . 0,0 66,2 100,0																				

Policy calculation sheet



BOX 1.0: Claims Calculation Logic

Claims Calculations Steps for one grid code can be outlined as below:-

1. Assess if incoming NDVI value lies within the growing season, i.e., growing season is marked 1 for that 10-day period else

2. don't calculate
3. Assess if incoming NDVI value > trigger, if yes put 0%
4. Assess if incoming NDVI value < exit ->100, if yes put 100%
5. Else Apply formula,

$$\text{Payout} = \left[\frac{\text{Trigger} - \text{Actual NDVI}}{\text{Trigger} - \text{Exit}} \right] * 100\% * \text{Sum insured}$$

OR

$$\left[1 - \frac{\text{Actual NDVI} - \text{exit}}{\text{Trigger} - \text{exit}} \right] * 100$$

Indemnity calculations example for a 10 day-period of incoming NDVI value of

January 10-20 period, grid code "2534", and policy ID "ABCD34". Policy ID "ABCD34" has 25% percentile as Trigger and 15% as exit.

Benchmark Trigger percentile	20%
Benchmark Threshold percentile	15%
Historical Tabular NDVI Value for 25 % Percentile (from NDVI Benchmark Table)	110
Historical Tabular Value for 15 % Percentile (from NDVI Benchmark Table)	90
This season 1km2 grid data tabular value (from Annual Data table)	100

In the example given above, Indemnity (as % of sum assured):

$$\left[1 - \frac{\text{tabular percentile value of Actual} - \text{tabular percentile data for Exit}}{\text{tabular percentile value of Exit} - \text{tabular percentile value of Trigger}} \right] * 100$$

So in this case, it will be: $\left[1 - \frac{100 - 90}{110 - 90} \right] * 100 = 50\%$

50% is the claims due percentage is calculated for a single 10-day period, similar values are calculated for all 10 day periods in the insurance coverage period as defined in the policy. Final claims are calculate by taking a weighted average of all 10-day periods. Weights are mentioned in the growing seasons* defined for the specific policy. 10-day claims and final claims are calculated for every 1km2 grid in the CPS zone for which policy is defined.

Policy ID	ABCD34			Claims due percentage per 10 day									Aggregated Claims per Grid		
GRID ID	Latitude	Longitude	CPS ID	Jan			Feb			Dec				
grid code	X_LL	Y_LL	CPS_zone	1	2	3	1	2	3	1	2	3	1	2	3
2543	37.9375	14.8482	10	50											

Aggregated Claims per grid calculations:-

Aggregated claims are calculated as the weighted average of individual 10 day claims. They must be updated as and when 10-day data comes, which will help Insurance Company to assess aggregated claims due till now. This information can also be shared with farmers, if required. E.g. for a policy cover-

ing 5 10-day periods, only the first 3 periods' claims are known, being: 0%, 15% and 7%. Then the accumulated claim percentage already amounts to $(0 + 15 + 7) / 5 = 4.4\%$. In the case, all 5 values all known, for example, 0%, 15%, 7%, 12% and 15%, final claims will be $(0 + 15 + 7 + 12 + 15) / 5 = 9.8\%$. This detail will be updated in against respective Grid code and under "Aggregated Claims per Grid".

Session Evaluation

Evaluate whether the session objectives have been met by asking your trainees the following questions

- i. What is the risk covered by VICI?
- ii. Can the insurance company manipulate the index in order to avoid making compensations?
- iii. How does greenness availability index indicate onset of drought?
- iv. Explain the significance of the trigger level
- v. Explain the significance of the exist level
- vi. Explain the minimum payout
- vii. Identify the geographical clustering of VICI coverage
- viii. Explain the reasons for the geographical clustering
- ix. What are the conditions for VICI compensations to be made?

Session four: The Value Proposition

Session objectives: After completing this session trainees should understand the following concepts

- i. What is the rational consumers considering in purchasing a good or a service?
- ii. What the value proposition offered by VICI product to the farmer?

The rational consumer will only buy those goods and services that add value to their lives. The key factors that consumers consider before buying a good or service include:

- i) Satisfaction of current need
- ii) Affordability of the service
- iii) Clarity of the service features

Question to consider: Does VICI product features as explained in the preceding sessions fulfill the key factors that consumers consider before buying a good or a service?

Go through each of the factors one by one with the trainees and discuss the extent to which the VICI product fulfils them:

- i) The recurrent drought problem is a current need for the farmers
- ii) The premiums are set at affordable levels
- iii) Concerted efforts have been made to clarify the product features- explore the opinion of the trainees about the clarity of the VICI product features.

The potential benefits to the farmers which include among others the following:

Socio-psychological benefits

- i) Emotional protection from risks of losses
- ii) Maintenance of social status in the society

Economic benefits

- i) Cost effective- the premium is affordable to the farmer and potential compensation is adequate
- ii) Economic stability- households will be cushioned against losses caused by drought
- iii) Improved quality of life- safeguard against dehumanizing effect of poverty

iii. The Task of creating awareness

As stated in the beginning of this training this tanning is conducted in the believe that trainees will spread the word of the product for others. There are many communication channels we can use today, with varying degrees of success, in creating awareness about different goods and services. Our choice depends on many factors which includes the target audience and the extent of the public we want to reach. Trainers should consider the economic, politician and socio cultural environment of a particular area in delivering their message about the product.

The target clients are farmers in four region of Ethiopia which might be characterized as:

- i) Mostly illiterate
- ii) Generally unfamiliar with the concept of insurance
- iii) Situated in a remote and infrastructure deficient areas

As part of this program Trainers are expected to teach the features and use of the VICI insurance product both to the kebele level counterparts of the project and the general public as a whole. In doing so they have to anticipated the nature of their audience and tailor the explanation to make it simpler and understandable.

Possible methods of reaching the target audience

- A formal training session with those individuals at the kebele level that are involved in this project
- Opening discussions in the community as a formal communication infrastructure for most of the channels are not well developed.
- Word of mouth communication can serve as a low cost and convincing forms of communication
- The power of referrals from friends, family or opinion leaders is particularly important among farmers.





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