Emerging Guidelines For Underwriting And Portfolio Management

Managerial Decision Making Tools For Named Peril Index Insurance

WORLD BANK GROUP
Finance & Markets

COURSE OBJECTIVES

By the end of this course, participants will be able to

- Appreciate the need for and use of risk modeling and risk metrics in managing index insurance portfolios
- Appreciate how risk metrics enable underwriting department objectives to be translated into measurable statistics
- Understand the product sustainability appraisal tree (PSAT) and use it to develop key risk metrics for each product process
- Understand and apply risk scoring techniques for risk reduction and market expansion
- Fully understand key decision metrics required from actuarial analysts; these metrics should be discussed with the insurance manager at each stage of the product and portfolio management process
- Appreciate the role of risk metrics in bringing transparency and ensuring that final decisions are not delegated to people without appropriate authority
- Appreciate the role of risk management committee guidelines and how they are used at each stage of the product process
- Use risk management committee guidelines to make optimal decisions within a short time for each of the following strategic areas:
  - Product evaluation
  - Product pricing
  - Market analysis
  - Value of insurance analysis (for example, does insurance reduce a financier's cost of risk?)
- Understand why reserving for named peril index insurance may be different from other traditional general insurance classes.

COURSE TOPICS

I. CRITICAL CONCEPTS IN NAMED PERIL INDEX INSURANCE

TOPIC 1: Basics of named peril index insurance

1.1 What is named peril index insurance?
1.2 Who are the main stakeholders in the risk transfer process?
1.3 How are named peril index insurance products developed?

II. ESSENTIAL KNOWLEDGE AND TOOLS

TOPIC 2 : Fundamentals of risk modeling and decision making

2.1 Motivation for decision tools
2.2 Motivation for risk modeling and risk metrics
2.3 Product sustainability appraisal tree (PSAT)

TOPIC 3: Basic opportunity assessment

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3.2 Linking the PSAT diagram to prerequisites for launching a named peril index insurance pilot project
3.3 Practical application

TOPIC 4: Is the insurance industry missing opportunities for market penetration?

Using actuarial analysis to promote farmer resilience and increase insurance penetration

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4.2 Missed opportunities
4.3 Identifying optimal crop type for a given geographical area
4.4 Identifying optimal crop varieties for a given area
4.5 Identifying optimal sowing window for crop variety in a given area

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5.3 Risk management committee guidelines template
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COURSE TOPICS

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- 6.1 Introduction
- 6.2 Linking the PSAT diagram to risk metrics defined in the risk management committee guidelines document
- 6.3 Risk management committee guidelines template
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- 7.1 Introduction
- 7.2 Linking the PSAT diagram to risk metrics used to determine client coverage levels for the Redesigned Index
- 7.3 Client information sheet template
- 7.4 Transactional and process controls
- 7.5 Practical application

TOPIC 8: Detailed market analysis

- 8.1 Introduction
- 8.2 Linking the PSAT diagram to risk metrics of the risk management committee guidelines
- 8.3 Risk management guidelines template
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- 9.1 Introduction
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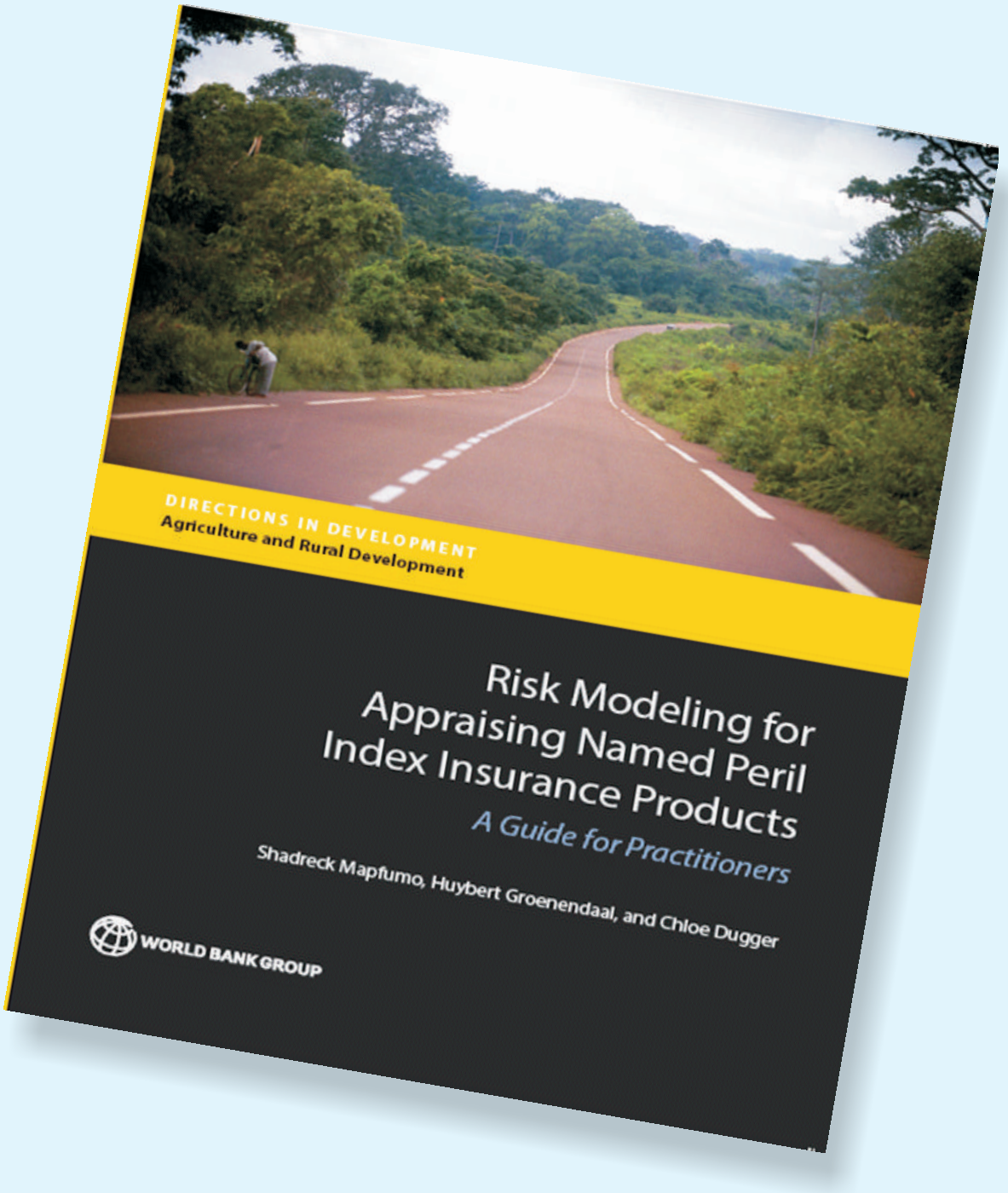
- 9.4 Transactional and process controls
- 9.5 Practical application

TOPIC 10: Reserving approaches for named peril index insurance products

- 10.1 Discussion questions for insurance industry leaders

APPENDIX: Detailed explanation of key risk metrics



BASED ON MATERIAL FROM THIS BOOK

TOPIC 1

CRITICAL CONCEPTS IN NAMED PERIL INDEX INSURANCE

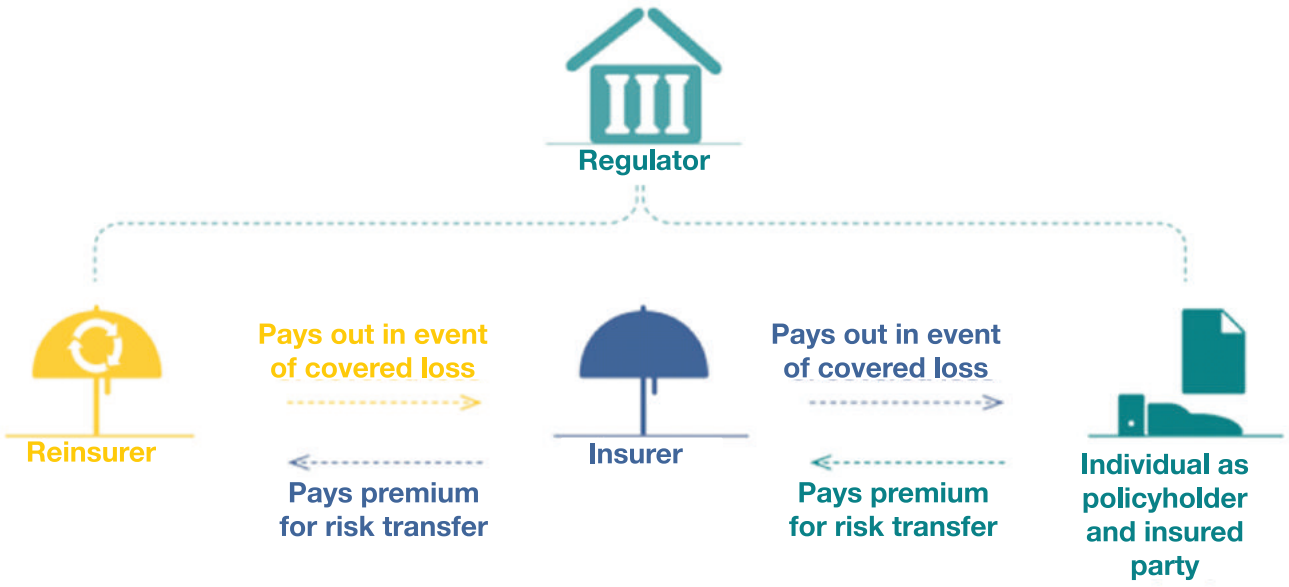
TOPIC 1: BASICS OF NAMED PERIL INDEX INSURANCE

1.1 What is named peril index insurance?

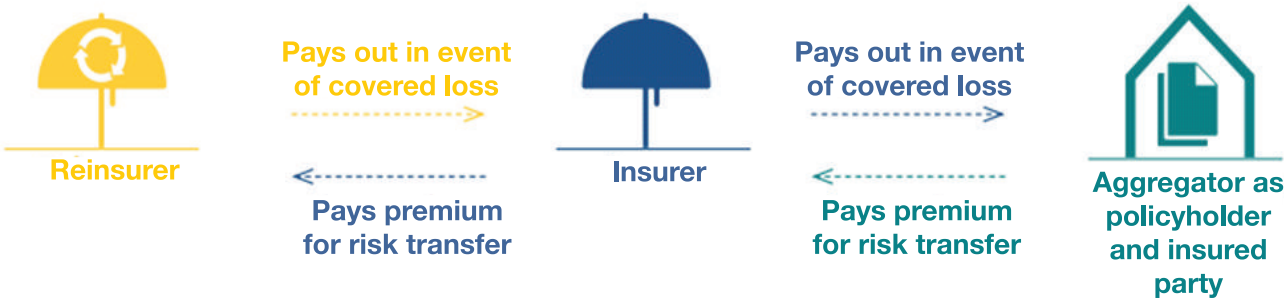
- An index insurance structure that is meant to protect the insured party against the effects of specific perils such as drought, excess rain, or typhoon

1.2 Who are the main stakeholders in the risk transfer process?

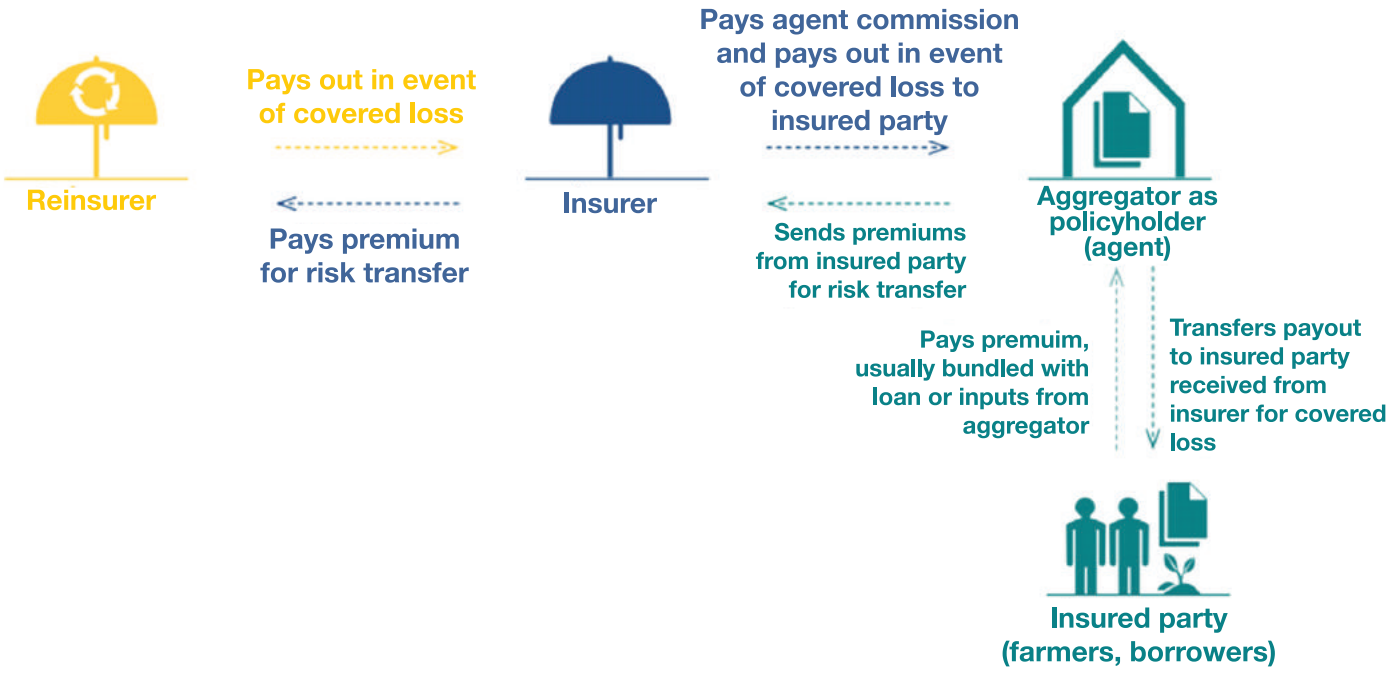
1.2.1 Individual as policyholder and insured party (in figure below)



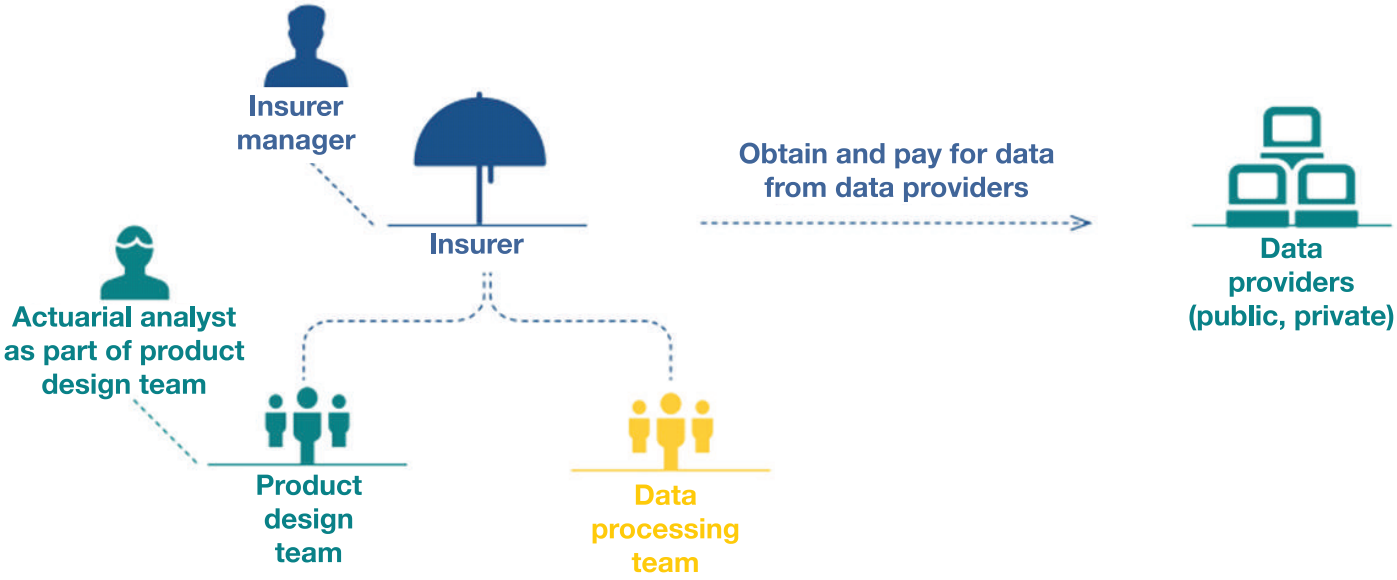
1.2.2 Aggregator as policyholder and insured party (in figure below)



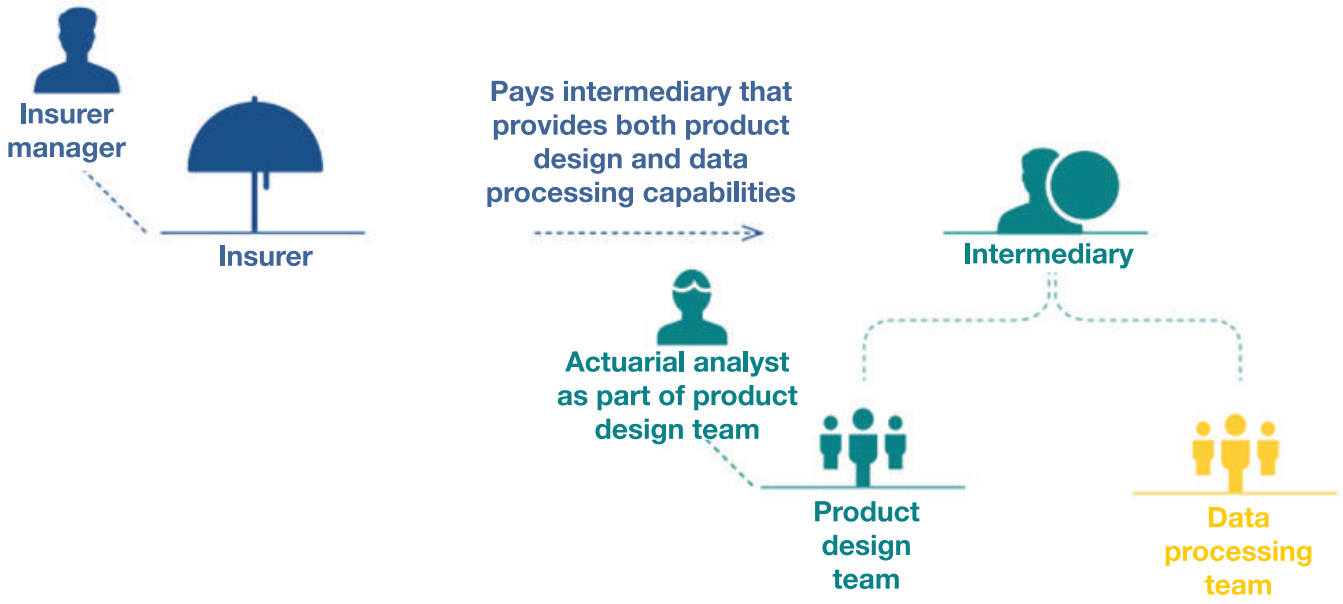
1.2.3 Aggregator as policyholder (agent) on behalf of the insured party (in figure below)



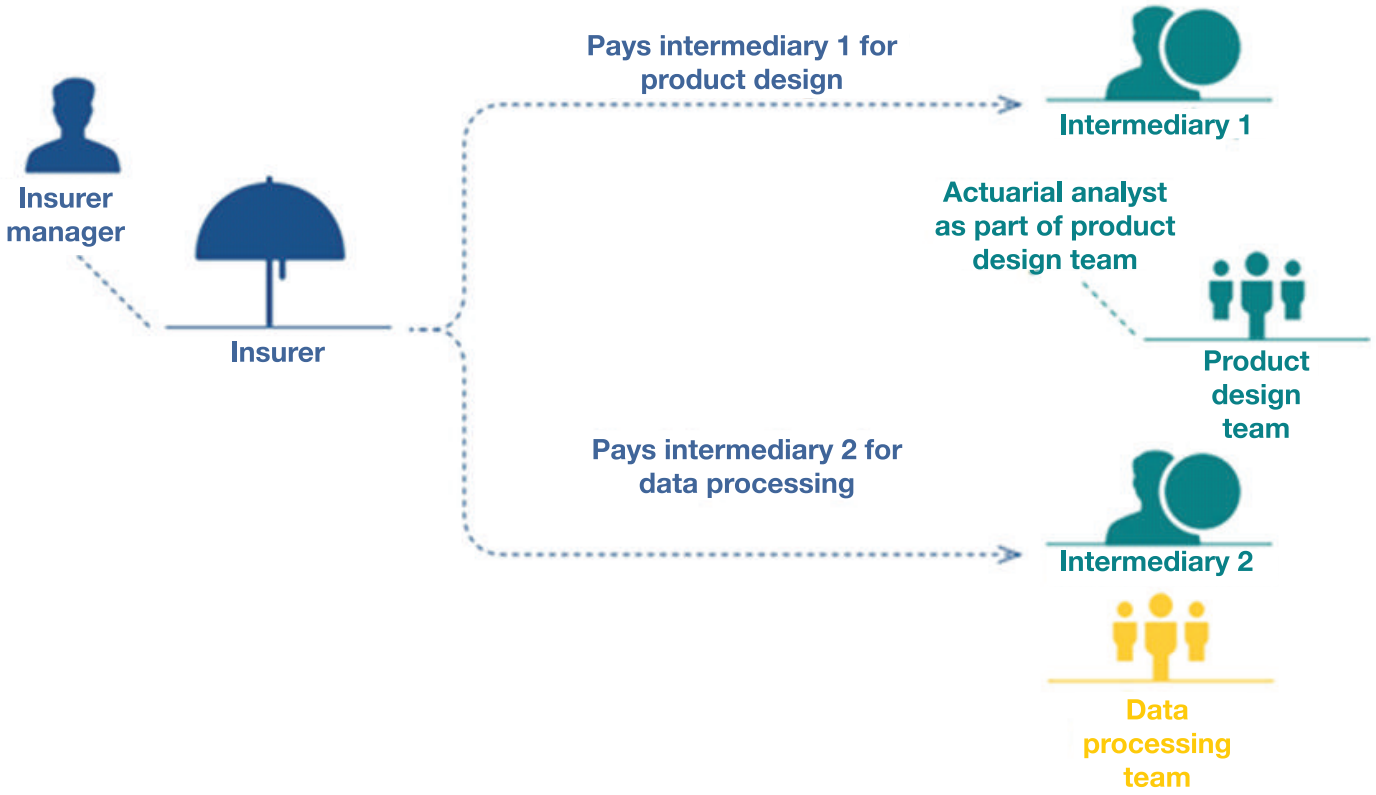
1.2.4 Product design and data processing team internal to insurer (in figure below)



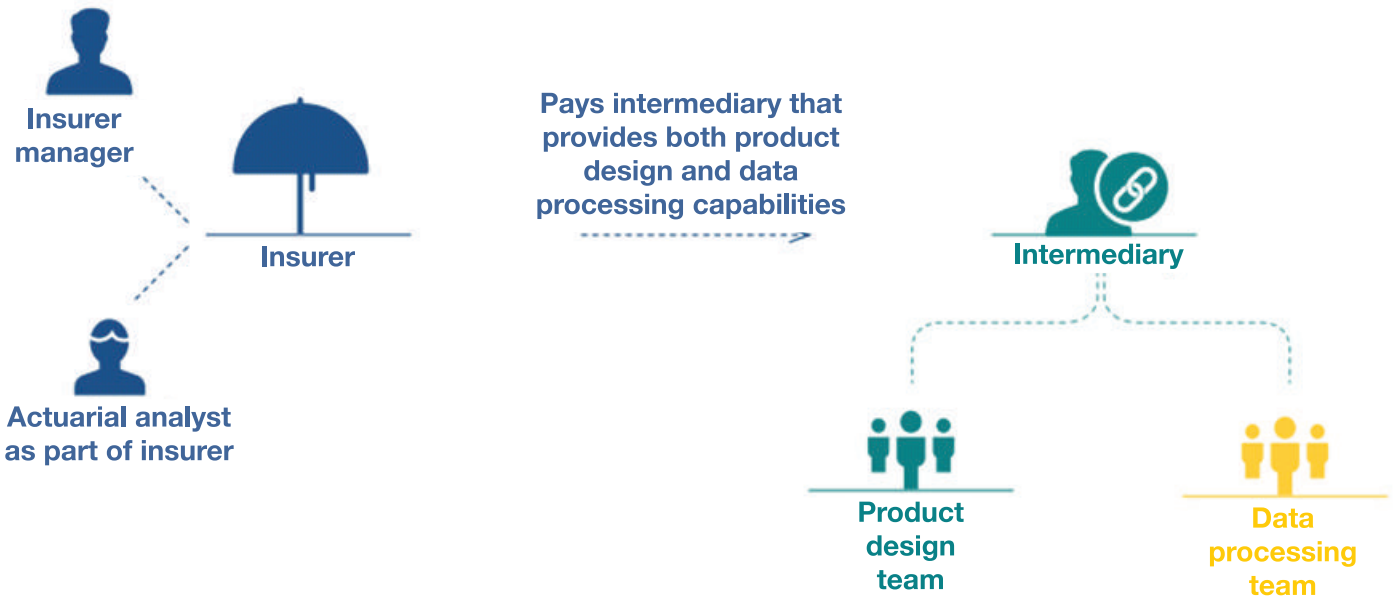
1.2.5 Product design and data processing team in one external (in figure below)



1.2.6 Product design and data processing teams in two separate external firms (in figure below)

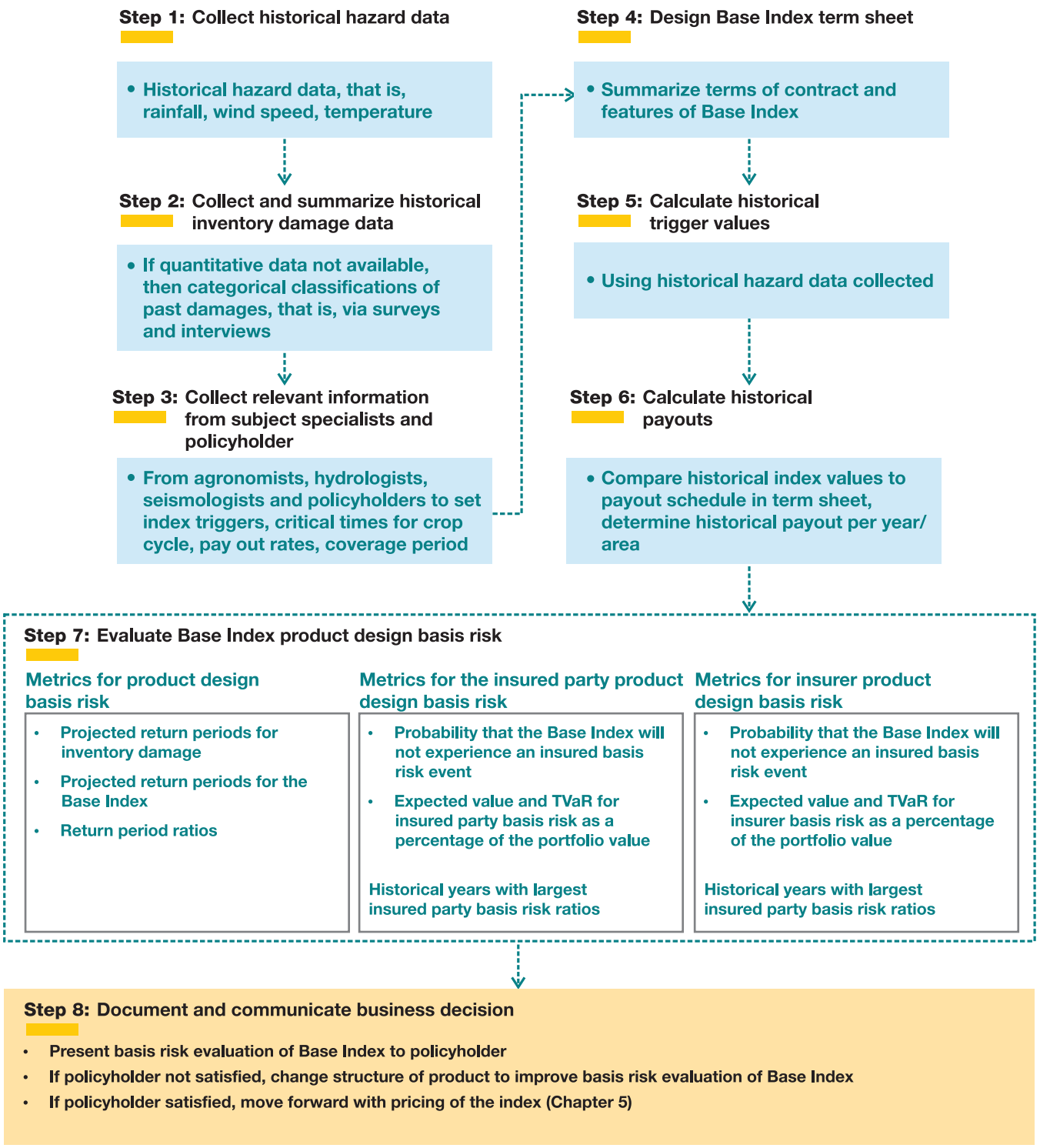


1.2.7 Product design and data processing team in one external (in figure below)



1.3 How are named peril index insurance products developed?

- The diagram below summarizes the product development and evaluation process.



Note: TVaR = tail value at risk.

TOPIC 2

ESSENTIAL KNOWLEDGE AND TOOLS

> "You can't manage what you can't measure"
>
> Peter Drucker

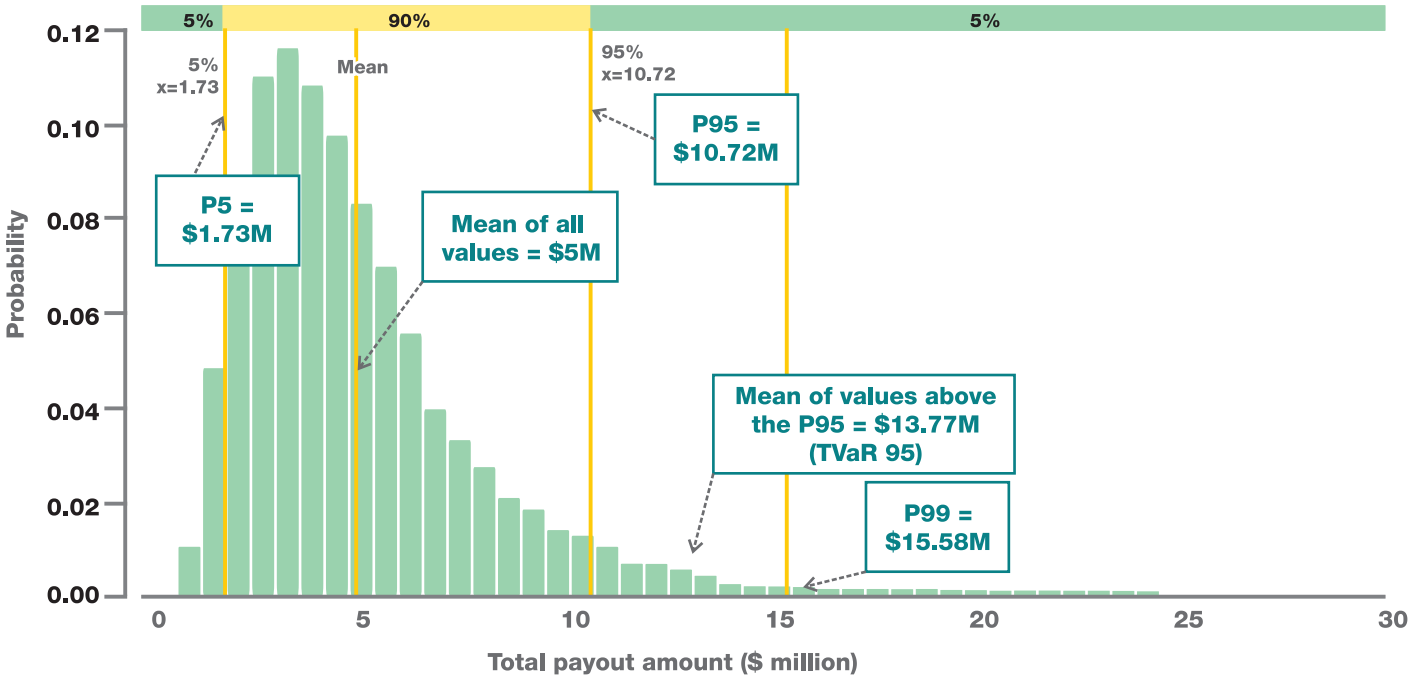
TOPIC 2: FUNDAMENTALS OF RISK MODELING AND DECISION MAKING

2.1 Motivation for decision tools

- Main activities involved in index insurance product management include data collection; feasibility studies; product design, evaluation, pricing, and approval; distribution; reinsurance; and claim settlement.
- In most cases, it is not cost-effective for insurance companies to do all these activities themselves. For example, product evaluation and pricing can be outsourced to leverage external expertise when entering a new market or if there are internal resource constraints.
- Data collection, feasibility studies, product design, and distribution are almost always outsourced to specialist firms or individual consultants.
- Our opinion is that the responsibility for product quality and profitability rests with the insurers and not the contractors.
- Decision-making authority (which risks to accept and at what price) rests with the insurance manager and should not be delegated to consultants or actuarial analysts.
- Because managers are very busy, tools are required that provide the manager with all the necessary information to make sound decisions within a very short time.
- Metrics and tools summarized in this manual can be used in interactions between insurance managers and external consultants or internal actuarial staff (actuarial analysts).
- Some of the benefits of having a tool kit with key decision metrics follow:
  - Promote transparency and accountability
  - Provide quantitative justification for business decisions including underwriting through an established framework
  - Contribute to thoughts on setting common standards for evaluating portfolios
  - Provide a basis for new ideas such as reserving for index insurance products by amortization of profits.

2.2 Motivation for risk modeling and risk metrics

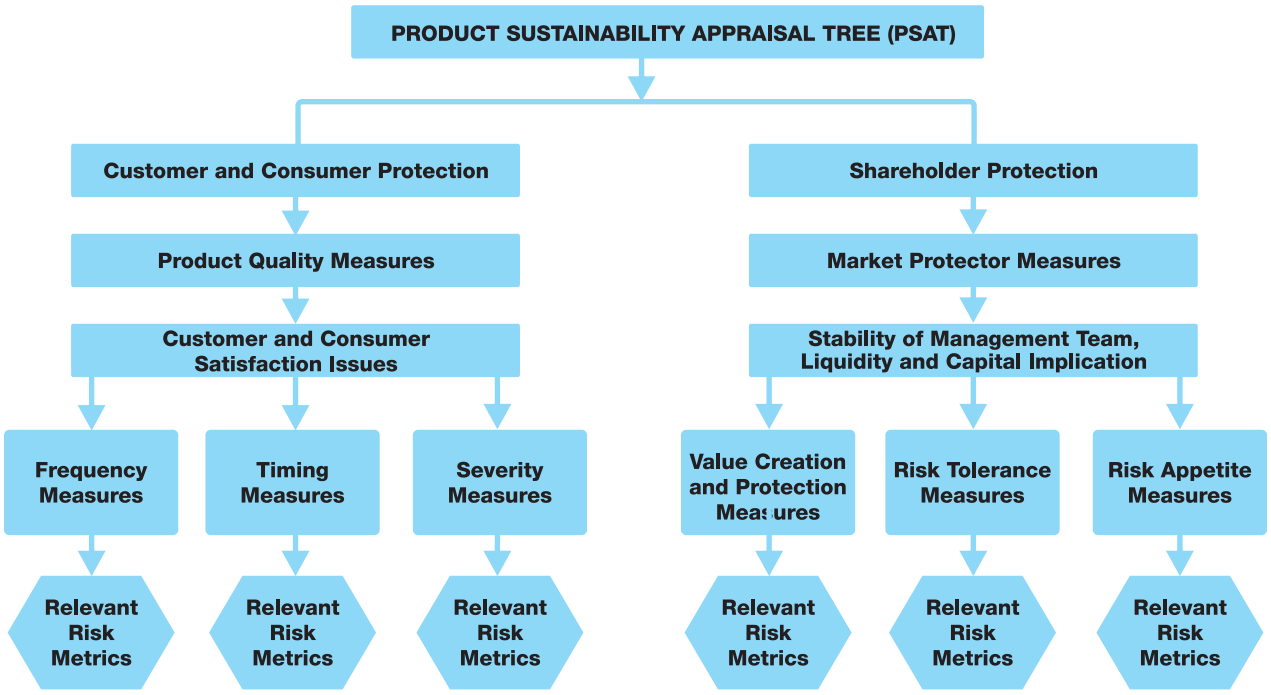
- Managers are often disappointed when actual portfolio outcomes differ from the expected values calculated by the actuarial analysts.
- Actuaries or other risk specialists cannot predict future events but can help provide a range of possible scenarios and their impact on company profitability.
- Such a range of possible scenarios can be summarized as a probability distribution of profits or losses.
- Managerial decisions should be based on summary metrics of this distribution and not on the expected value only.
- The power of risk modeling rests in the fact that it allows actuaries and other risk specialists to use the available historical data to describe a distribution along with parameters with the highest likelihood of generating the observed historical values.
- Risk modeling can take correlations into account by using copulas.
- The selected distributions and parameters are then used to generate thousands of likely scenarios for the next risk period.
- For most risk metrics discussed in this manual, the following values are calculated from the simulations and used for decision making:
  - Expected value
  - 90 percent confidence interval
  - Probable maximum loss at a given confidence level (tail value at risk)
- Management and regulators are mostly concerned with tail risk, and risk modeling provides realistic estimates of what risk parameters, such as probable maximum loss, could be.



- Manager is better prepared for the unexpected if future patterns do not follow the past

2.3 Product sustainability appraisal tree (PSAT)

- Two key drivers of product sustainability are product quality and profitability.
- Quality products easily meet clients' expectations and satisfy consumer protection guidelines.
- Product quality measures can be grouped into frequency, timing, and severity measures.
- Relevant metrics in each of these categories should be developed by the insurers and regulators to ensure consistent appraisal of named peril index insurance products across the whole industry.
- Market protection measures are aimed at protecting shareholders and avoiding bankruptcies.
- Relevant metrics can be grouped into value creation and protection, risk tolerance, and risk appetite measures.
- The diagram below summarizes these classifications.



TOPIC 3

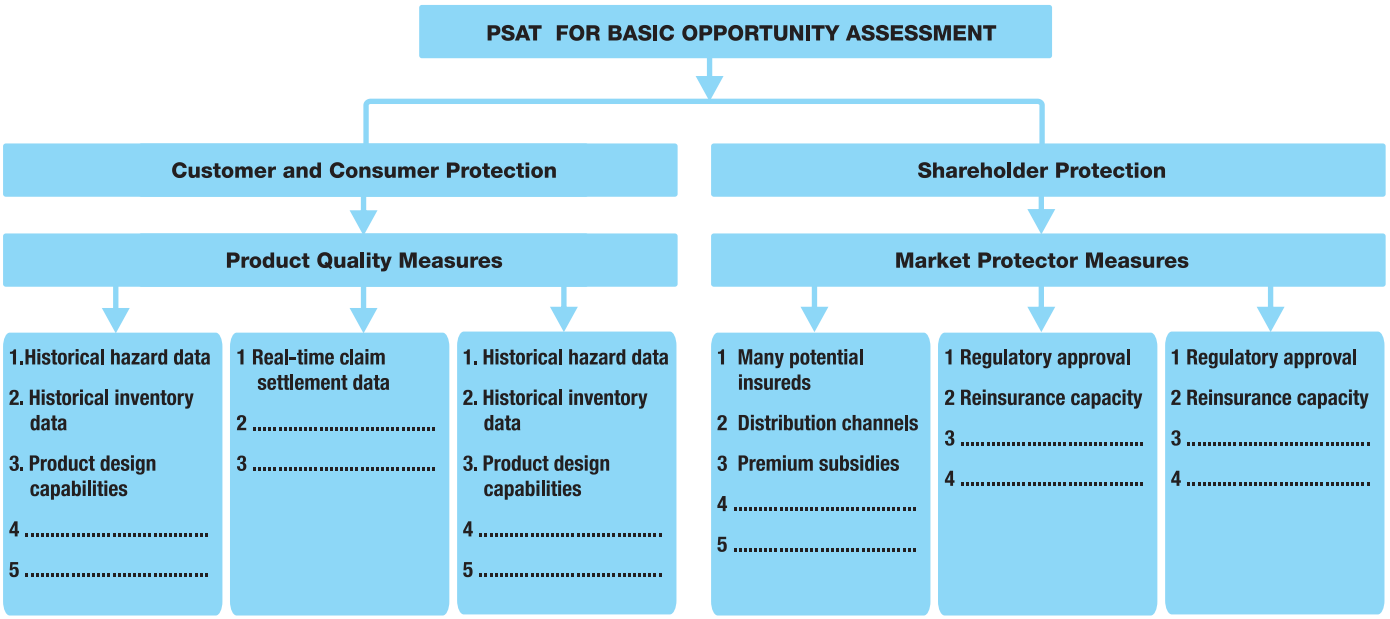
BASIC OPPORTUNITY ASSESSMENT

TOPIC 3: BASIC OPPORTUNITY ASSESSMENT

3.1. Introduction

- Understanding the market need is the first step in the pilot phase.
- Before launching a pilot project, a prefeasibility study is conducted to ensure certain prerequisites are met.
- The actuarial analyst will compile anywhere from a two- to three-page summary report to a 100-page full report for management review.
- Decision on project launch is made based on the summary note and the associated evaluation form.
- Section 3.2 highlights how the PSAT diagram links to the prerequisites for pilot launch.

3.2. Linking the PSAT diagram to the prerequisites for launching a named peril index insurance pilot project



3.3. Practical application

Context: Your actuarial analyst used a template of the prefeasibility study summary sheet to extract important information from a 107-page prefeasibility study report completed by an international firm that you hired three months ago. Based on the information from the report, you would like to decide whether sufficient prerequisites are in place to warrant launching a weather index insurance pilot.

Activity: Please study the summary report below (Resource A) and then complete the technical evaluation form (Resource B). Discuss your results with your colleagues and justify your final decision.

Resource A: Prefeasibility study summary report

Prerequisite	*Key points from the prefeasibility study report*
Potential policyholders	• More than 500,000 smallholder farmers work with five distribution channels that have expressed interest in the index product. • A rural bank and an agribusiness, Buyer Goods, are also interested in purchasing an index product to protect their agrifinance and input advance portfolios.
Subject specialists	• In each of the target areas, a number of local extension officers, specialists from agribusinesses and suppliers, and employees of research institutions work closely with smallholder farmers. • The report provides a list of three to five recommended subject specialists for each area. These specialists helped the consulting firm, Research Plus, develop qualitative classifications of past damage.
Historical hazard data	• The country's meteorological department operates 100 weather stations, which have recorded 30 years of good quality daily historical rainfall data. Of these weather stations, 50 have also recorded 20 years of daily temperature, humidity, and wind speed data. The data can be accessed for a nominal fee. • ARC2 satellite daily rainfall data are available from 1983 at a pixel size of 10 kilometers by 10 kilometers.
Real-time claim settlement hazard data	• Of the 100 meteorological department weather stations, 80 are fully functional and can provide real-time data. • ARC2 daily rainfall satellite data are also available and can be accessed for free.
Historical inventory damage data	• Research Plus worked with selected subject specialists in each area to develop area-specific categorical classifications of past damages. • Substantial qualitative information is available from FEWS NET, local government agencies, farmers, and local agribusiness firms.
Product design capabilities	• Two specialist insurance intermediaries offer product design services and charge a fair service fee. Hazard Analytics has the stronger reputation in the local and international market. • Several international product design firms can also be hired to build internal capacity at the insurer. • The report recommends outsourcing the product design function to Hazard Analytics.
Distribution channels	• Five distribution channels have expressed interest in bundling named peril index insurance with existing services provided to maize farmers: a rural bank, a microfinance institution, a seed company, the agribusiness Buyer Goods, and a nongovernmental organization. • The maize value chain is well organized. The government purchases 50 percent of yields for the national grain reserve, and several local and national input suppliers cooperate with financial institutions to provide inputs on credit.
Reinsurance capacity	• All five reinsurance companies currently working with your company have expressed interest in supporting this class of business.
Regulatory approval	• The regulator has agreed that the index product may be launched, but has requested sample policy documents.
Premium subsidies	• Premium subsidies are currently not available.

Resource B: Technical evaluation of the prefeasibility study		
	YES	*NO*
1. Are sufficient potential policyholders interested in buying this product?		
2. Is a sufficient pool of subject specialists available to assist with product design?		
3. Are sufficient historical hazard data series available to design and price products?		
4. Are data providers able to provide real-time or near real-time hazard data for claim settlement during each risk period?		
5. Are sufficient qualitative or quantitative inventory damage data for product design and product evaluation available?		
6. Are sufficient local or international product design capabilities available?		
7. Are distribution channels available through which the product can be sold effectively?		
8. Are reinsurers willing to offer the necessary reinsurance capacity?		
9. Has regulatory approval been granted to underwrite this product?		
10. Are premium subsidies available?		
Total		
Final decision		
Should the company initiate a pilot project? (Recommendation by the manager and the actuarial analyst)		
If no, give reasons why.		
Name of actuarial analyst	.....	
Actuarial analyst's signature	.....	
Name of insurance manager	.....	
Insurance manager's signature	.....	

TOPIC 4

IS THE INSURANCE INDUSTRY MISSING OPPORTUNITIES FOR MARKET PENETRATION?

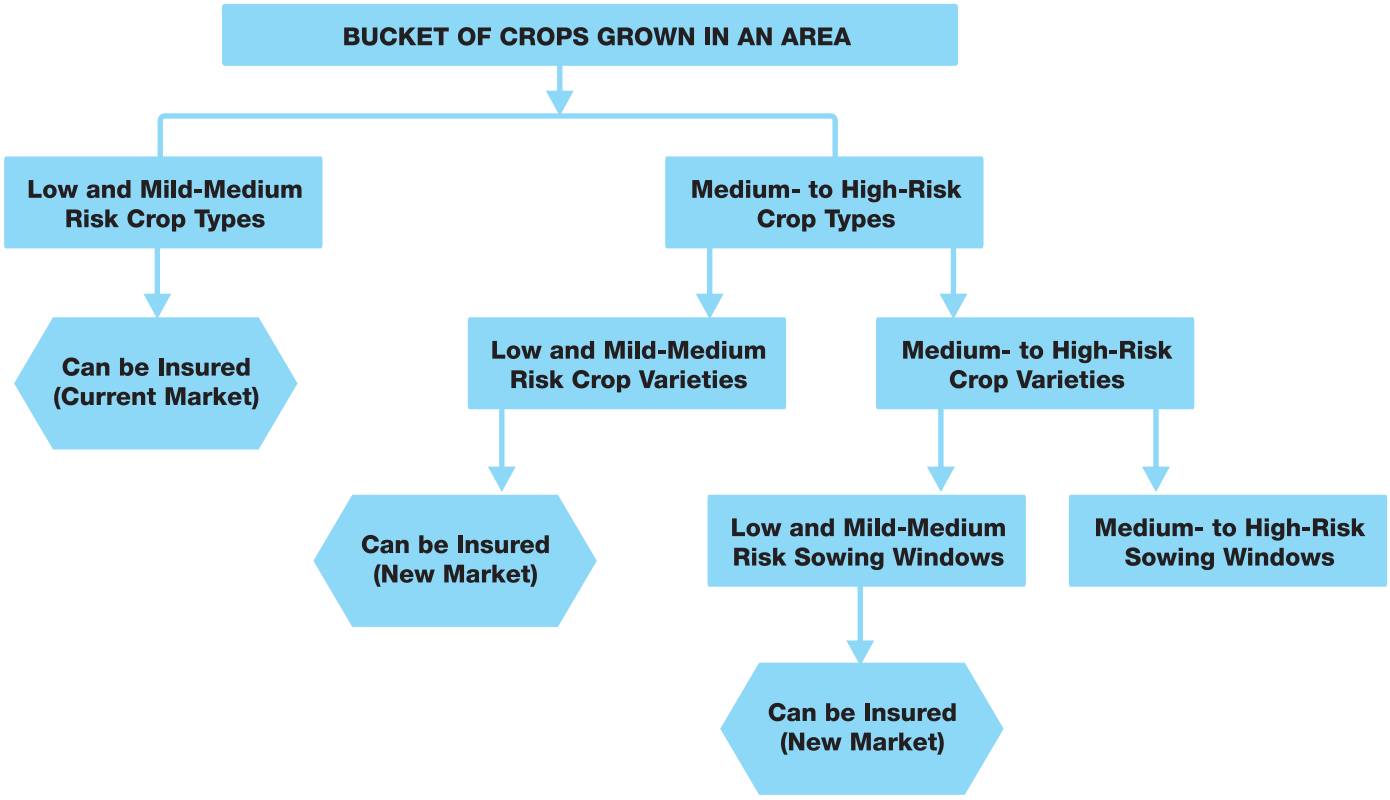
TOPIC 4: IS THE INSURANCE INDUSTRY MISSING OPPORTUNITIES FOR MARKET PENETRATION?

Using actuarial analysis to promote farmer resilience and increase insurance penetration

4.1. Introduction

- Currently most insurers only evaluate products presented to them that are based on current farmer practices.
- Depending on policyholder ability and willingness to pay, a deal may or may not be executed.
- If insurers offered risk reduction and control advice, many deals that are currently dropped could translate into new opportunities for the industry.
- Results of risk analysis could still generate income for insurers that can sell their analysis to financiers for a fee if the financier is not interested in insurance but wants to know which crops and varieties to lend to.
- The more finance flowing into agriculture, the higher the demand for risk management tools such as insurance.
- The diagram in section 4.2 shows how new market opportunities can be opened through the use of actuarial analysis and risk scoring.

4.2. Missed opportunities



4.3. Identifying optimal crop type for a given geographical area

- There are many times when farmers suffer crop failure because they are growing a crop type and variety that is not suitable for the local climatic conditions.
- Because of high chance of crop failure, premium rates are also usually commensurately high.
- By looking at payout ratios and premium rates generated from a pricing exercise, a ranking system can be used to advise farmers about crops they should focus on.
- Below is an example of a ranking exercise that could inform farmer and financier decisions.

Step 1: Summarize the results of the risk modeling process.

Average payout rate based on the most recent years*							
Crop type	All-year average (percent)	25-year average (percent)	20-year average (percent)	15-year average (percent)	10-year average (percent)	5-year average (percent)	Median of averages (percent)
Maize	21.6	20.4	18.3	18.3	17.5	9.3	18.3
Sorghum	9.0	9.1	8.1	5.9	5.4	4.0	7.0
Beans	8.9	9.7	8.6	6.9	4.0	4.7	7.8
Cowpea	10.1	11.1	9.9	9.7	4.6	5.8	9.8
Green gram	8.3	9.6	8.5	6.7	4.0	4.7	7.5

** Can also use average payout plus loadings to reflect cost of total risk.*

Step 2: (a) For each average block (5-year, 10-year, 15-year, and so on) rank crop type by average payout rate from 1 (lowest rate) to 5 (highest rate). (b) For each crop, add the rank values along each row and find total score

Crop type	All-year averagee	25-year average	20-year average	15-year average	10-year average	5-year average	Median of averages	Total score
Maize	5	5	5	5	5	5	5	35
Sorghum	3	1	1	1	4	1	1	12
Beans	2	3	3	3	1	2	3	17
Cowpea	4	4	4	4	3	4	4	27
Green gram	1	2	2	2	1	2	2	12

Step 3: Indicate generally accepted premium rate and commercial premium rates for each of the crop types.

Crop type	Commercial premium rate (percent)	Generally accepted premium rate (percent)
Maize	23.9	10
Sorghum	9.3	
Beans	10.2	
Cowpea	12.7	
Green gram	9.9	

Step 4: Indicate which crops policyholders will accept on the basis of their ranking and premium affordability.

Crop type ranking	Crop type	Affordable premium level?
Lowest risk	Sorghum	Yes
Mild-medium risk	Green gram	Yes
Medium risk	Beans	No
High risk	Cowpea	No
Very high risk	Maize	No

Question: Which crops should be promoted? What about the risky crops, should they just be ignored?

4.4. Identifying optimal crop varieties for a given area

- What if the problem is with the crop variety that farmers are using in that area?
- Could a change in variety have led to better yields and low historical payout ratios?
- In the current scenario, we see that the commercial premium for maize is 23 percent, yet farmers may still want to grow this crop, especially when it is their staple crop.
- The actuarial team could investigate whether there are maize varieties that could be better for the area than the popular variety grown now (180-day variety).
- Farmers could then be advised to change crop variety instead of crop type and still be able to get access to finance and affordable insurance coverage and be assured of a good harvest in most years.
- The scoring exercise below looks at available maize varieties to see whether there are less risky varieties that can be insured at affordable rates.

Step 1: Summarize the results of the risk modeling process.

	Average payout rate based on the most recent years*						
Maize variety	All-year average (percent)	25-year average (percent)	20-year average (percent)	15-year average (percent)	10-year average (percent)	5-year average (percent)	Median of averages (percent)
Variety 1 (200 days to maturity)	28.7	27.2	25.5	27.0	27.6	23.6	27.1
Variety 2 (180 days to maturity)	21.6	20.4	18.3	18.3	17.5	9.3	18.3
Variety 3 (160 days to maturity)	13.2	12.4	10.6	10.8	11.5	4.0	11.2
Variety 4 (140 days to maturity)	9.9	9.7	8.5	8.0	7.6	4.0	8.3
Variety 5 (120 days to maturity)	8.8	8.5	7.3	5.2	3.7	4.0	6.2

** Can also use average payout plus loadings to reflect cost of total risk.*

Step 2: **(a) For each block (5-year, 10-year, 15-year, and so on) rank crop type by average payout rate from 1 (lowest rate) to 5 (highest rate). (b) For each crop, add the rank values along each row and find total score.**

Maize variety	All-year average	25-year average	20-year average	15-year average	10-year average	5-year average	Median of averages	Total score
Variety 1 (200 days to maturity)	5	5	5	5	5	5	5	35
Variety 2 (180 days to maturity)	4	4	4	4	4	4	4	28
Variety 3 (160 days to maturity)	3	3	3	3	3	1	3	19
Variety 4 (140 days to maturity)	2	2	2	2	2	1	2	13
Variety 5 (120 days to maturity)	1	1	1	1	1	1	1	7

Step 3: **Indicate generally accepted premium level and determine commercial premium rates for each of the crop types.**

Maize variety	Commercial premium rate (percent)	Generally accepted premium rate (percent)
Variety 1 (200 days to maturity)	34.9	10
Variety 2 (180 days to maturity)	23.9	
Variety 3 (160 days to maturity)	14.6	
Variety 4 (140 days to maturity)	10.8	
Variety 5 (120 days to maturity)	8.3	

Step 4: **Indicate which crops policyholders will accept on the basis of their ranking and premium affordability.**

Maize variety ranking	Maize variety	Affordable premium level?
Lowest risk	120 days to maturity	Yes
Mild-medium	140 days to maturity	No
Medium risk	160 days to maturity	No
High risk	180 days to maturity	No
Very high risk	200 days to maturity	No

4.5. Identifying optimal sowing period for a given geographical area

- For the whole sowing period (March 1–21) Variety 5 is best suited for this area; therefore, maize farmers could be insured at less than 10 percent if this variety is adopted.
- However, there will still be some farmers that may prefer Variety 4 (140 days to maturity).
- Let's explore whether there is a sowing period that would lead to reduced risk for this given variety.
- The analysis below seeks to identify an optimal sowing window for the 140-day maize variety in this given area.

Step 1: Summarize the results of the risk modeling process.

	Average payout rate based on the most recent years*						
Sowing window maize variety: 140 days to maturity	All-year average	25-year average	20-year average	15-year average	10-year average	5-year average	Median of averages
March 1 planting	9.9	9.7	8.5	8.0	7.6	4.0	8.3
March 6 planting	8.8	8.8	7.4	6.5	8.0	4.0	7.7
March 11 planting	7.2	5.9	4.7	3.1	2.6	0.0	3.9
March 16 planting	7.6	6.5	6.0	5.8	4.7	3.5	5.9
March 21 planting	10.1	9.4	9.2	9.2	7.2	4.3	9.2

** Can also use average payout plus loadings to reflect cost of total risk.*

Step 2: ((a) For each block (5-year, 10-year, 15-year, and so on) rank crop type by average payout rate from 1 (lowest rate) to 5 (highest rate). (b) For each crop, add the rank values along each row and find total score

Sowing window maize variety: 140 days to maturity	All-year average	25-year average	20-year average	15-year average	10-year average	5-year average	Median of averages	Total score
March 1 planting	4	5	4	4	4	3	4	28
March 6 planting	3	3	3	3	5	3	3	23
March 11 planting	1	1	1	1	1	1	1	7
March 16 planting	2	2	2	2	2	2	2	14
March 21 planting	5	4	5	5	3	5	5	32

Step 3: Indicate generally accepted premium level and determine commercial premium rates for each of the crop types.

Sowing window maize variety: 140 days to maturity	Commercial premium rate (percent)	Generally accepted premium rate (percent)
March 1 planting	10.8	10
March 6 planting	10.0	
March 11 planting	5.4	
March 16 planting	7.8	
March 21 planting	11.9	

Step 4: Indicate which crops policyholders will accept on the basis of their ranking and premium affordability.

Sowing window ranking	Sowing window	Affordable premium level?
Lowest risk	March 11–15	Yes
Mild-medium	March 16–20	Yes
Medium risk	March 6–10	Yes
High risk	March 1–5	No
Very high risk	March 21–26	No

TOPIC 5

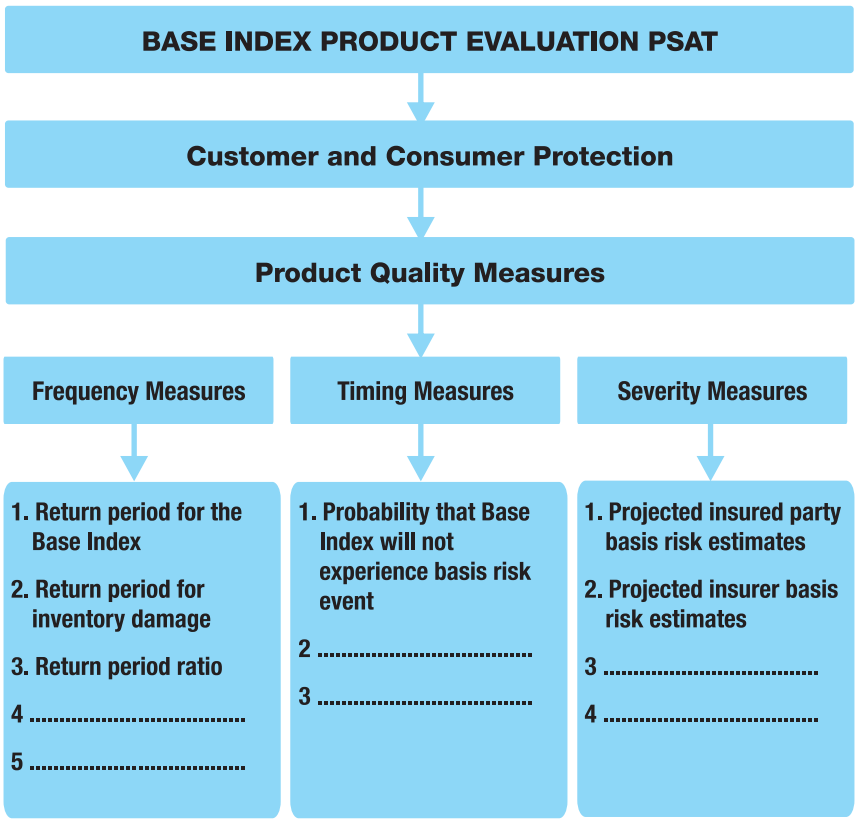
BASE INDEX PRODUCT EVALUATION

TOPIC 5: BASE INDEX PRODUCT EVALUATION

5.1. Introduction

- The aim of this process is to evaluate how well the Base Index responds to the losses suffered by insured parties.
- The process considers a specific crop variety sown during a specified window.
- Product design basis risk results from the inability of the Base Index to ever perfectly reflect the reality on the ground because its payouts reflect average losses, not the losses of the specific insured party.
- In addition to other metrics, estimates of basis risk amounts are generated and used to develop appropriate response mechanisms.
- This process has statistical credibility when performed for a portfolio rather than for single contracts.
- The idea is to find out how well a portfolio of index structures performs.
- The PSAT diagram highlights emerging risk metrics in evaluating Base Indices.

5.2. Linking the PSAT diagram to the risk metrics of the risk management committee guidelines



5.3. Risk management committee guidelines template

- From the PSAT diagram, a risk management committee guidelines template is developed.
- The committee then uses its own data or industry data to provide the values for each metric.
- The guidelines should be updated as necessary but at least once a year to ensure they are up to date and do not inhibit business development.
- Once the guidelines are established at the beginning of the year, operational underwriting staff should use them to process transactions.

Decision metric		Risk management committee guidelines for index products	
		Insured party basis risk	**Insurer basis risk**
Frequency measures	Projected return period for inventory damage and the Base Index		
	Return period ratio		
Timing measures	Probability that the Base Index will not experience a basis risk event		
Severity measures	Expected value for basis risk as a percentage of the portfolio value		
	TVaR at 95 percent for basis risk as a percentage of the portfolio value		

Note: TVaR = tail value at risk.

5.4. Transactional and process controls

- Step 1: Before undertaking the risk modeling exercise, agree on the inputs and assumptions to be used. (Don't waste time if you don't agree on assumptions and inputs.)
- Step 2: After the risk modeling exercise, use the results and the applicable risk management committee guidelines to guide managerial decisions

5.5. Practical application

- **Context:** After agreeing with your actuarial analyst that sufficient prerequisites for implementing a pilot exist , you engaged Hazard Analytics, a specialist product design consultancy firm. The company submitted a portfolio of indices and historical payouts, historical inventory damage ratios, and portfolio breakdown for the target client, Mass Bank. Based on the information provided, you are not sure how good the contract structures are and have asked your actuarial analyst to use the information to provide risk metrics that can be evaluated against the risk management committee guidelines.
- **Activity:** Using the risk management guidelines (Resource A), risk modeling results (Resource B), and the managerial and actuarial decision summary sheet (Resource C), evaluate this portfolio of products and determine the most sensible next step, documenting it in Resource C.

Resource A: Risk management guidelines

Decision metric		Risk management committee guidelines for index products	
		Insured party basis risk	**Insurer basis risk**
Frequency measures	Projected return period for inventory damage and the Base Index	The projected return periods must be as close as possible to each other for each area, especially for damage or payout levels of 50 percent and 70 percent.	The projected return periods must be as close as possible to each other for each area, especially for damage or payout levels of 50 percent and 70 percent.
	Return period ratio	More than 70 percent of geographical areas must have ratios of at least 0.7	More than 70 percent of geographical areas must have ratios below 1.2
Timing measures	Probability that the Base Index will not experience a basis risk event	Must be greater than 75 percent for each area	Must be greater than 75 percent for each area
Severity measures	Expected value for basis risk as a percentage of the portfolio value	Must be less than 5 percent	Must be less than 5 percent
	TVaR at 95 percent for basis risk as a percentage of the portfolio value	Must be less than 20 percent	Must be less than 20 percent

Note: TVaR = tail value at risk.

Resource B: Risk modeling results—Base Index insurance product evaluation

Inventory damage return period	INVENTORY DAMAGE RETURN PERIODS	AREA A	AREA B	AREA C	AREA D	AREA E	AREA F	AREA G	AREA H	AREA I	AREA J
	RETURN PERIOD @ 70% DAMAGE LEVEL	62	40	42	19	29	27	22	20	19	17
Base Index payout return period	BASE INDEX RETURN PERIODS	AREA A	AREA B	AREA C	AREA D	AREA E	AREA F	AREA G	AREA H	AREA I	AREA J
	RETURN PERIOD @ 70% PAYOUT LEVEL	52	30	43	22	26	27	33	34	29	12
Return period ratio	RETURN PERIOD RATIOS	AREA A	AREA B	AREA C	AREA D	AREA E	AREA F	AREA G	AREA H	AREA I	AREA J
	RETURN PERIOD @ 70% DAMAGE/ PAYOUT LEVEL	1.18	1.33	0.99	0.88	1.08	0.98	0.66	0.57	0.67	1.14
Probability that the indices will not suffer a basis risk event	PROBABILITY THAT BASE INDEX WILL NOT EXPERIENCE AN INSURED BASIS RISK EVENT	AREA A	AREA B	AREA C	AREA D	AREA E	AREA F	AREA G	AREA H	AREA I	AREA J
		90%	88%	88%	81%	81%	84%	82%	79%	74%	78%

Magnitude of insured party basis risk	PROJECTED INSURED PARTY BASIS RISK AMOUNTS		AMOUNT	% OF TOTAL SUM INSURED
		LOWER	0	0%
		EXPECTED	276,655	3%
		UPPER	978,750	12%
		TVaR	1,310,579	16%
Magnitude of insurer basis risk	PROJECTED INSURER BASIS RISK AMOUNTS		AMOUNT	% OF TOTAL SUM INSURED
		LOWER	0	0%
		EXPECTED	159,939	2%
		UPPER	709,878	9%
		TVaR	1,009,740	13%

Note: TVaR = tail value at risk.

Resource C: Managerial and actuarial decision summary sheet			
		Managerial and actuarial decision	
	Decision metric	Insured party basis risk (respond Yes/No)	Insured party basis risk (respond Yes/No)
Frequency measures	Are the projected return periods for inventory damage and the Base Index reasonably close to each other?		
	Is the return period ratio requirement satisfied?		
Timing measures	Has the minimum value been achieved for the probability that the Base Index will not experience a basis risk event?		
Severity measures	Is the expected value for basis risk as a percentage of the portfolio value within the acceptable range?		
	Is the TVaR at 95 percent for basis risk as a percentage of the portfolio value within the acceptable range?		
	Final decision		
	Present Base Index to policyholder		
	Restructure index for specific areas		
	Consider alternative solutions (non-index)		
Name of actuarial analyst			
Signature of actuarial analyst			
Name of insurance manager			
Signature of insurance manager			

Note: TVaR = tail value at risk.

TOPIC 6

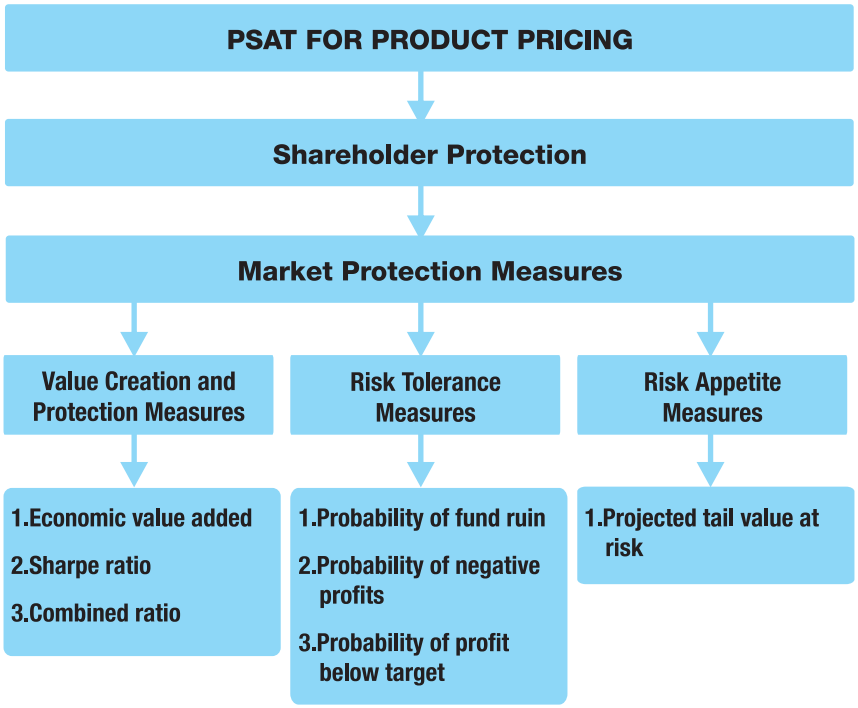
PRODUCT PRICING METRICS

TOPIC 6: PRODUCT PRICING METRICS

6.1. Introduction

- Once a decision has been made to proceed with a portfolio of product structures, the next step is product pricing.
- In arriving at the final price, the effect of reinsurance on the cost must be assessed, and a decision made on how much to reinsure.
- When markets are soft, reinsurance capital may be much cheaper than the insurer's, which would lead to better premiums for clients; when markets are not soft, premium rates will be quite high.
- In any case, reinsurance is critical for this class of business.
- It is important to evaluate three pricing scenarios—without reinsurance, with proportional reinsurance, and with both proportional and nonproportional reinsurance structures.

6.2. Linking the PSAT diagram to the risk metrics defined in the risk management committee guidelines document



6.3. Risk management committee guidelines template

- From the PSAT diagram, a risk management committee guidelines template is developed.
- The committee then uses its own data or industry data to provide the values for each metric.
- The guidelines should be updated as necessary but at least once a year to ensure they are up to date and do not inhibit business development.
- Once the guidelines are established at the beginning of the year, operational staff should use them to process transactions.

	Decision metric	Risk management committee guidelines
Value creation and protection measures		
	Economic value added	
	Sharpe ratio	
	Combined ratio (projected loss ratio + total expense costs)	
	Indicative decision	
Risk tolerance measures		
	Probability of fund ruin	
	Probability of negative profit	
	Probability of profit below target profit margin	
	Indicative decision	
Risk appetite measures		
	TVaR of projected losses	

Note: TVaR = tail value at risk.

6.4 Transactional and process controls

Step 1: Before risk modeling exercise, agree on the inputs and assumptions to be used for the risk modeling exercise. (Don't waste time if you don't agree on assumptions and inputs.)

Step 2: After the risk modeling exercise, use the results and the applicable risk management committee guidelines to guide managerial decisions.

6.5 Practical application

Context: Now let's assume that you are happy with the quality of the Base Index because your risk metrics are within acceptable risk management committee guidelines and you proceeded to price the product. The analyst and underwriting manager agreed to price the product under three scenarios: (1) assuming no reinsurance, (2) with proportional reinsurance only, and (3) with both proportional and nonproportional reinsurance. The reinsurance market is currently soft and stable.

Activity: Using the risk management guidelines (Resource A), risk modeling results (Resource B), and the managerial and actuarial decision summary sheet (Resource C), evaluate this portfolio of products and determine the most sensible next step, documenting it in Resource C.

Resource A: Risk management guidelines

	Decision metric	Risk management committee guidelines
Value creation and protection measures		
	Economic value added	Must be greater than 0 percent
	Sharpe ratio	Must be greater than 0 percent
	Combined ratio (projected loss ratio + total expense costs)	Must be less than 100 percent
	Indicative decision	
Risk tolerance measures		
	Probability of fund ruin	Must be less than 2 percent
	Probability of negative profit	Must be less than 25 percent
	Probability of profit below target profit margin	Must be less than 25 percent
	Indicative decision	
Risk appetite measures		
	TVaR of projected losses	TVaR net reinsurance must be less than $200,000

Note: TVaR = tail value at risk.

6.5.1. Pricing model outputs for Base Index—No reinsurance

ITERATION #	GROSS PREMIUM RATE (%)	PROBABILITY OF NEGATIVE PROFIT (%)	PROBABILITY OF FUND RUIN (%)	PROBABILITY OF PROFIT MARGIN BELOW TARGET (%)	PROJECTED LOSSES ($)				PROJECTED COMBINED RATIO (%)				PROJECTED PROFIT MARGIN (%)			PROJECTED EVA (%)			SHARPE RATIO
					5 % Lower	Expected	95 % Upper	TVaR	5 % Lower	Expected	95 % Upper	TVaR	5 % Lower	Expected	95 % Upper	5 % Lower	Expected	95 % Upper	
1	3%	66%	62%	68%	-	619,287	2,038,858	2,524,657	15%	273%	865%	1067%	-766%	-173%	85%	-103%	-27%	6%	-0.68
2	4%	60%	56%	63%	-	619,287	2,038,858	2,524,657	15%	209%	652%	804%	-553%	-109%	85%	-100%	-24%	10%	-0.58
3	5%	55%	51%	58%	-	619,287	2,038,858	2,524,657	15%	170%	525%	646%	-426%	-70%	85%	-96%	-20%	13%	-0.47
4	6%	50%	47%	53%	-	619,287	2,038,858	2,524,657	15%	144%	440%	541%	-341%	-44%	85%	-92%	-16%	17%	-0.37
5	7%	46%	42%	49%	-	619,287	2,038,858	2,524,657	15%	126%	379%	466%	-280%	-26%	85%	-89%	-13%	20%	-0.27
6	8%	41%	39%	45%	-	619,287	2,038,858	2,524,657	15%	112%	334%	409%	-234%	-12%	85%	-85%	-9%	24%	-0.17
7	9%	38%	35%	42%	-	619,287	2,038,858	2,524,657	15%	101%	298%	366%	-199%	-1%	85%	-82%	-5%	28%	-0.07
8	10%	34%	32%	38%	-	619,287	2,038,858	2,524,657	15%	92%	270%	331%	-170%	8%	85%	-78%	-2%	31%	0.03
9	11%	31%	29%	35%	-	619,287	2,038,858	2,524,657	15%	85%	247%	302%	-147%	15%	85%	-74%	2%	35%	0.14
10	12%	28%	26%	32%	-	619,287	2,038,858	2,524,657	15%	80%	227%	278%	-128%	20%	85%	-71%	6%	39%	0.24

Note: EVA = economic value added; TVaR = tail value at risk.

6.5.2. Pricing model outputs for Base Index—Proportional reinsurance only

ITERATION #	GROSS PREMIUM RATE (%)	PROBABILITY OF NEGATIVE PROFIT (%)	PROBABILITY OF FUND RUIN (%)	PROBABILITY OF PROFIT MARGIN BELOW TARGET (%)	PROJECTED LOSSES ($)				PROJECTED COMBINED RATIO (%)				PROJECTED PROFIT MARGIN (%)			PROJECTED EVA (%)			SHARPE RATIO
					5 % Lower	Expected	95 % Higher	TVaR	5 % Lower	Expected	95 % Higher	TVaR	5 % Lower	Expected	95 % Upper	5 % Lower	Expected	95 % Higher	
1	3%	66%	47%	68%	-	123,857	407,772	504,931	15%	273%	865%	1067%	-766%	-173%	85%	-103%	-27%	6%	0.00
2	4%	60%	43%	63%	-	123,857	407,772	504,931	15%	209%	652%	804%	-553%	-109%	85%	-100%	-24%	10%	-0.58
3	5%	55%	39%	58%	-	123,857	407,772	504,931	15%	170%	525%	646%	-426%	-70%	85%	-96%	-20%	13%	-0.47
4	6%	50%	35%	53%	-	123,857	407,772	504,931	15%	144%	440%	541%	-341%	-44%	85%	-92%	-16%	17%	-0.37
5	7%	46%	32%	49%	-	123,857	407,772	504,931	15%	126%	379%	466%	-280%	-26%	85%	-89%	-13%	20%	-0.27
6	8%	41%	29%	45%	-	123,857	407,772	504,931	15%	112%	334%	409%	-234%	-12%	85%	-85%	-9%	24%	-0.17
7	9%	38%	26%	42%	-	123,857	407,772	504,931	15%	101%	298%	366%	-199%	-1%	85%	-82%	-5%	28%	-0.07
8	10%	34%	24%	38%	-	123,857	407,772	504,931	15%	92%	270%	331%	-170%	8%	85%	-78%	-2%	31%	0.03
9	11%	31%	22%	35%	-	123,857	407,772	504,931	15%	85%	247%	302%	-147%	15%	85%	-74%	2%	35%	0.14
10	12%	28%	20%	32%	-	123,857	407,772	504,931	15%	80%	227%	278%	-128%	20%	85%	-71%	6%	39%	0.24

Note: EVA = economic value added; TVaR = tail value at risk.

6.5.3. Pricing model outputs for Base Index—Proportional and nonproportional reinsurance

ITERATION #	GROSS PREMIUM RATE (%)	PROBABILITY OF NEGATIVE PROFIT (%)	PROBABILITY OF FUND RUIN (%)	PROBABILITY OF PROFIT MARGIN BELOW TARGET (%)	PROJECTED LOSSES ($)				PROJECTED COMBINED RATIO (%)				PROJECTED PROFIT MARGIN (%)			PROJECTED EVA (%)			SHARPE RATIO
					5 % Lower	Expected	95 % Upper	TVaR	5 % Lower	Expected	95 % Upper	TVaR	5 % Lower	Expected	95 % Upper	5 % Lower	Expected	95 % Upper	
1	3%	70%	39%	71%	-	62,861	117,277	127,937	15%	179%	320%	348%	-221%	-79%	85%	-126%	-42%	54%	-0.62
2	4%	65%	16%	67%	-	62,861	117,277	127,937	15%	138%	244%	265%	-144%	-38%	85%	-106%	-23%	73%	-0.31
3	5%	60%	7%	63%	-	62,861	117,277	127,937	15%	113%	198%	215%	-98%	-13%	85%	-87%	-3%	93%	0.00
4	6%	56%	2%	59%	-	62,861	117,277	127,937	15%	97%	168%	182%	-68%	3%	85%	-67%	16%	113%	0.31
5	7%	52%	0%	55%	-	62,861	117,277	127,937	15%	85%	146%	158%	-46%	15%	85%	-48%	36%	132%	0.61
6	8%	42%	0%	52%	-	62,861	117,277	127,937	15%	76%	130%	140%	-30%	24%	85%	-28%	56%	152%	0.92
7	9%	20%	0%	44%	-	62,861	117,277	127,937	15%	70%	117%	126%	-17%	30%	85%	-8%	75%	172%	1.23
8	10%	10%	0%	23%	-	62,861	117,277	127,937	15%	64%	107%	115%	-7%	36%	85%	11%	95%	191%	1.54
9	11%	4%	0%	12%	-	62,861	117,277	127,937	15%	60%	98%	106%	2%	40%	85%	31%	114%	211%	1.85
10	12%	1%	0%	6%	-	62,861	117,277	127,937	15%	56%	91%	98%	9%	44%	85%	51%	134%	230%	2.16

Note: EVA = economic value added; TVaR = tail value at risk.

Resource C: Managerial and actuarial decision summary sheet			
		Managerial and actuarial decision	
	Decision metric	(Indicate minimum acceptable premium rate)	
Value creation and protection measures			
	Economic value added		
	Sharpe ratio		
	Combined ratio (projected loss ratio + total expense costs)		
	Indicative decision		
Risk tolerance measures			
	Probability of fund ruin		
	Probability of negative profit		
	Probability of profit below target profit margin		
	Indicative decision		
Risk appetite measures			
	TVaR of projected losses		
Final decision	**Write**		
	Do not write		
	Consider next reinsurance scenario or other risk management tools		
Name of actuarial analyst			
Signature of actuarial analyst			
Name of insurance manager			
Signature of insurance manager			

Note: TVaR = tail value at risk.

TOPIC 7

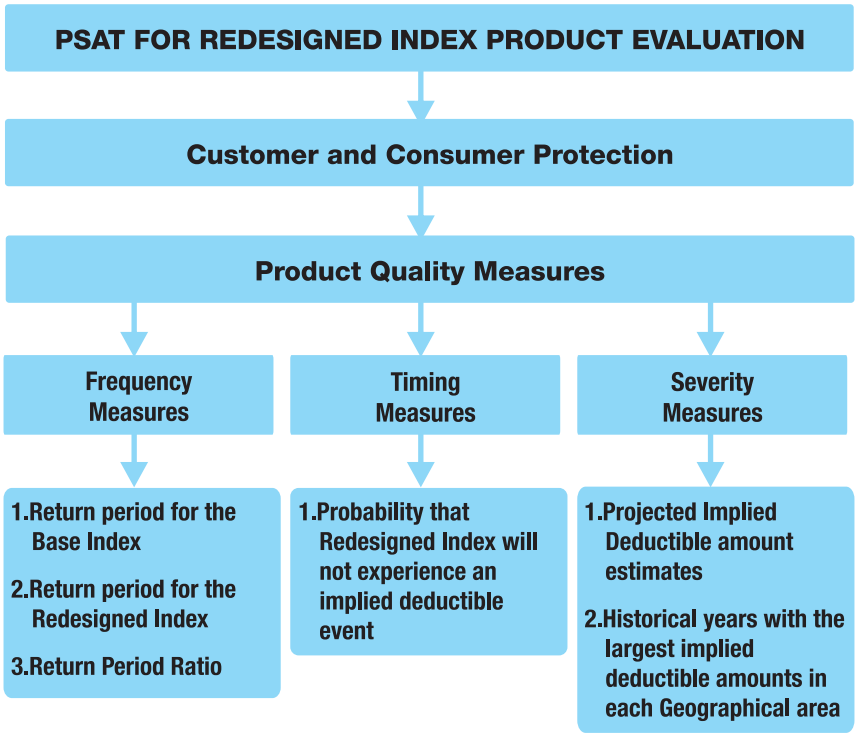
REDESIGNED INDEX PRODUCT EVALUATION

TOPIC 7: REDESIGNED INDEX PRODUCT EVALUATION

7.1. Introduction

- Many times, the Base Index is more expensive than what the client is able and willing to pay.
- Some parameters in the Base Index are then changed to lower premiums; this becomes the Redesigned Index.
- It is critical to ensure that the client understands the implications to the coverage level provided of choosing the Redesigned Index.
- During the risk period, the insurer should also provide updates on the performance of both the Base Index and the Redesigned Index.
- Providing updates helps identify and separate product design basis risk from the implied deductible.

7.2. Linking the PSAT diagram to the risk metrics used to determine client coverage levels for the Redesigned Index



7.3. Client information sheet template

- Using the PSAT diagram, the management team develops a client information sheet.
- The manager and actuarial analyst use the client information sheet to explain to the target client the difference between the Base Index (comprehensive coverage) and the Redesigned Index (reduced coverage).

7.4. Transactional and process controls

Step 1: Before the risk modeling exercise, agree on the inputs and assumptions to be used for risk modeling exercise. (Don't waste time if you don't agree on assumptions and inputs.)

Step 2: After the risk modeling exercise, use the results to compile the client information sheet. The client information sheet is not shown here but would be similar to the sheets in Base Index product evaluation topic, except that here we are looking at the implied deductible and not basis risk.

7.5. Practical application

Context: When you priced the Base Index, the resulting premium was 10 percent; however, you know that your client indicated a willingness to buy this product only if the premium is 6 percent. You have adjusted the contract payout triggers and payout rates to meet this expected price, but you need to make sure that your client has an idea of the risk they are assuming by choosing the redesigned product instead of the Base Index.

Activity: Given the client information sheet overleaf

- If your client is a sophisticated bank that wants to protect its own portfolio, after explaining the product features in the table below, would you still sell them a product if they indicated they are happy to proceed?
- What if the bank is only working as an aggregator but the ultimate risk rests with the smallholder farmers? Would you still proceed to offer the cover?
- Assume that during the next crop season the contract that was sold to the bank does not trigger a payout. You are told by your claims team that they have information that farmers actually suffered some mild to medium crop damage. The CEO of the bank calls you saying that your contract suffered basis risk, and he would like you to advise how you will manage this situation. You want to prove that basis risk is not the problem. What information should your actuarial team provide you to be able to present your case to the bank CEO?

Geographical areas included in the portfolio	AREA A	AREA B	AREA C	AREA D	AREA E	AREA F	AREA G	AREA H	AREA I	AREA J
Total sum insured by area (US$)	140,160	285,975	1,200,000	425,000	2,252,250	282,000	992,040	1,200,325	425,150	800,100
Historical years with largest payout differences between Base Index and Redesigned Index	1996	1989	**1986**	2007	1990	1987	2000	2010	1998	2008
Base Index payout ratio (%)	79	15	23	40	67	31	53	61	63	18
Redesigned Index payout ratio (%)	29	2.5	10	0	17	0	3	11	13	5
Implied deductible ratio (%)	50	12.5	13	40	50	31	50	50	50	13
Probability that client will not incur an implied deductible (%)	91	80	87	75	78	81	84	84	81	55

PORTFOLIO-LEVEL PARAMETERS				
	5th percentile	Expected value	95th percentile	TVaR
Projected implied deductible amount	0	309,342	990,402	1,283,575
Projected implied deductible as percentage of portfolio size	0	4	12	16

Premium rate for the Base Index (%)	10
Premium rate for the Redesigned Index (%)	6

TOPIC 8

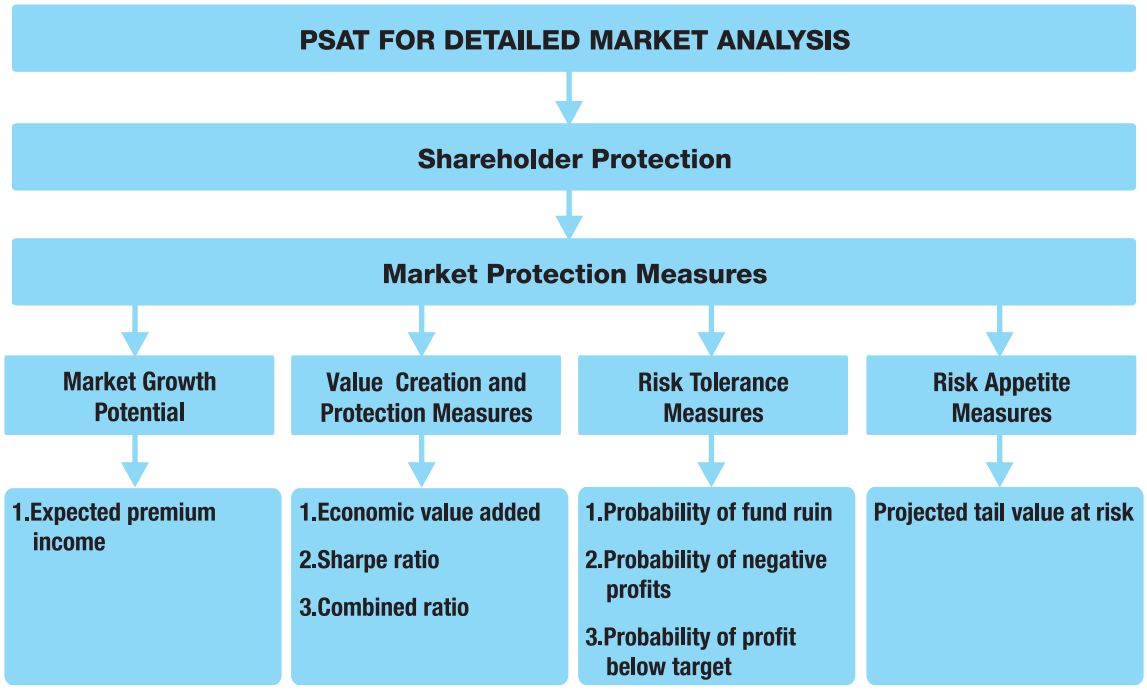
DETAILED MARKET ANALYSIS

TOPIC 8: DETAILED MARKET ANALYSIS

8.1. Introduction

- If a pilot phase is successful, the insurer needs to assess whether demand for this product is sufficient to warrant long-term investment of its scarce resources.
- A detailed market analysis must be undertaken for this assessment.

8.2. Linking the PSAT diagram to the risk metrics of the risk management committee guidelines



8.3. Risk management guidelines template

- From the PSAT diagram, a risk management committee guidelines template is developed.
- The committee then uses its own data or industry data to provide the values for each metric.
- The guidelines should be updated as necessary but at least once a year to ensure they are up to date and do not inhibit business development.
- Once the guidelines are established at the beginning of the year, operational staff should use them to process transactions.

	Decision metric	Risk management committee guidelines
Growth target measures	Expected premium income	
	Tier1	
	Tier2	
	Tier3	
	Do not qualify	
Value creation and protection measures		
	Economic value added	
	Sharpe ratio	
	Combined ratio	
Risk tolerance measures		
	Probability of negative profit	
	Probability of profits below target profit margin	
Overall performance		
	Total expected premium income across all qualifying segments	

8.4. Transactional and process controls

Step 1: Before risk modeling exercise, agree on the inputs and assumptions to be used for risk modeling exercise. (Don't waste time if you don't agree on assumptions and inputs.)

Step 2: After the risk modeling exercise, use the results and the applicable risk management committee guidelines to guide managerial decisions.

8.5. Practical application

Context: Your company ran a successful pilot and feels that index insurance is a good risk management tool for your market. You now want to know if you should allocate your scarce resources to expanding this product line.

Activity: Using the risk management guidelines (Resource A), risk modeling results (Resource B), and the managerial and actuarial decision summary sheet (Resource C), evaluate this portfolio of products and determine the most sensible next step, documenting it in Resource C.

8.5.1. Resource A: Risk management guidelines

	Decision metric	Risk management committee guidelines
Growth target measures	Expected premium income	
	Tier1	⩾ $1million
	Tier2	⩾ $500,000 and < $1million
	Tier3	⩾ $250,000 and < $500,000
	Do not qualify	< $250,000
Value creation and protection measures		
	Economic value added	> 0 percent
	Sharpe ratio	> 0 percent
	Combined ratio	< 100 percent
Risk tolerance measures		
	Probability of negative profit	< 50 percent
	Probability of profits below target profit margin	< 50 percent
Overall performance		
	Total expected premium income across all qualifying segments	> $ 3 million

8.5.2. Resource B: Risk modeling results—Product pricing

FIRM SIZE	MARKET SEGMENT	PROJECTED PREMIUM INCOME ($)			PROJECTED LOSSES ($)			PROJECTED COMBINED RATIO (%)			PROJECTED PROFIT MARGIN (%)			PROBABILITY OF NEGATIVE PROFIT (%)	PROBABILITY OF PROFIT BELOW TARGET (%)	PROJECTED EVA (%)			SHARPE RATIO
		Lower	Expected	Upper	Lower	Expected	Upper	Lower	Expected	Upper	Lower	Expected	Upper			5%	Expected	95%	
SMALL	Rural Banks	240,000	339,984	420,000	120,419	250,980	391,980	61%	94%	122%	-22%	6%	39%	41%	60%	-49%	7%	73%	0.27
	MFIs	240,000	237,924	240,000	96,393	175,727	245,972	61%	94%	123%	-23%	6%	39%	40%	59%	-74%	14%	114%	0.29
	Seed Companies	200,000	201,328	200,000	82,427	147,884	206,200	61%	93%	122%	-22%	7%	39%	40%	58%	-71%	14%	111%	0.31
	Agribusinesses	450,000	600,840	750,000	241,359	443,643	637,312	62%	94%	122%	-22%	6%	38%	40%	59%	-58%	10%	88%	0.29
	NGOs	100,000	158,735	200,000	58,664	117,439	185,918	62%	94%	123%	-23%	6%	38%	41%	60%	-47%	6%	69%	0.26
MEDIUM	Rural Banks	300,000	450,150	600,000	173,439	333,439	485,926	56%	89%	117%	-17%	11%	44%	31%	51%	-42%	18%	90%	0.53
	MFIs	300,000	300,000	300,000	122,870	2221,223	306,022	56%	89%	117%	-17%	11%	44%	31%	50%	-58%	30%	132%	0.57
	Seed Companies	300,000	1,150,680	1,500,000	440,867	851,861	1,281,944	56%	89%	117%	-17%	11%	44%	31%	50%	-42%	18%	89%	0.53
	Agribusinesses	1,350,000	1,800,990	2,250,00	655,337	1,326,719	2,077,966	56%	89%	117%	-17%	11%	44%	30%	50%	-37%	17%	81%	0.54
	NGOs	200,000	224,000	300,000	86,806	164,962	271,023	56%	89%	117%	-17%	11%	44%	30%	50%	-34%	14%	72%	0.53
LARGE	Rural Banks	300,000	310,020	300,000	122,051	228,473	317,577	50%	84%	112%	-12%	16%	49%	22%	40%	-27%	24%	83%	0.79
	MFIs	-	-	-	-	-	-	52%	84%	112%	-12%	16%	48%	22%	40%	0%	0%	0%	
	Seed Companies	400,000	798,680	1,200,000	264,113	588,167	907,474	51%	84%	112%	-12%	16%	49%	22%	40%	-25%	22%	80%	0.77
	Agribusinesses	1,800,000	1,772,010	1,800,000	690,479	1,310,472	1,835,175	52%	84%	112%	-12%	16%	48%	21%	41%	-41%	42%	138%	0.83
	NGOs	250,000	499,500	750,000	167,947	369,754	572,421	52%	84%	113%	-12%	16%	48%	22%	41%	-26%	21%	78%	0.76

Note: EVA = economic value added; MFI = microfinance institution; NGO = nongovernmental organization.

8.5.3. Resource C: Managerial and actuarial decision summary sheet

TIER	FIRM SIZE	MARKET SEGMENT	PROJECTED PREMIUM INCOME	VALUE CREATION AND PROTECTION			RISK TOLERANCE		QUALIFYING PREMIUM INCOME
				Is EVA criterion satisfied? (YES/NO)	Is Sharpe Ratio criterion satisfied? (YES/NO)	Is combined ratio criterion satisfied? (YES/NO)		Is the probability of profits below target profit margin satisfied? (YES/NO)	
Tier 1	Large	Agribusinesses	$1,772,010	YES	YES	YES	YES	YES	$1,772,010
	Medium	Agribusinesses	$1,800,990	YES	YES	YES	YES	YES	$1,800,990
	Medium	Seed Companies	$1,150,680	YES	YES	YES	YES	YES	$1,150,680
Tier 2	Large	NGOs	$499,500	YES	YES	YES	YES	YES	$499,500
	Large	Seed Companies	$798,680	YES	YES	YES	YES	YES	$798,680
	Small	Agribusinesses	$600,840	YES	YES	YES	YES	NO	0
Tier 3	Large	Rural Banks	$310,020	YES	YES	YES	YES	YES	$310,020
	Medium	MFIs	$300,000	YES	YES	YES	YES	YES	$300,000
	Medium	Rural Banks	$450,150	YES	YES	YES	YES	NO	0
	Small	Rural Banks	$339,984	YES	YES	YES	YES	YES	$339,984
Total projected premium									$6,971,864

	Final decision	
	Pursue business opportunity	
	Defer investment in the product until market conditions improve	
Name of actuarial analyst		
Signature of actuarial analyst		
Name of insurance manager		
Signature of insurance manager		

Note: EVA = economic value added; MFI = microfinance institution; NGO = nongovernmental organization.

TOPIC 9

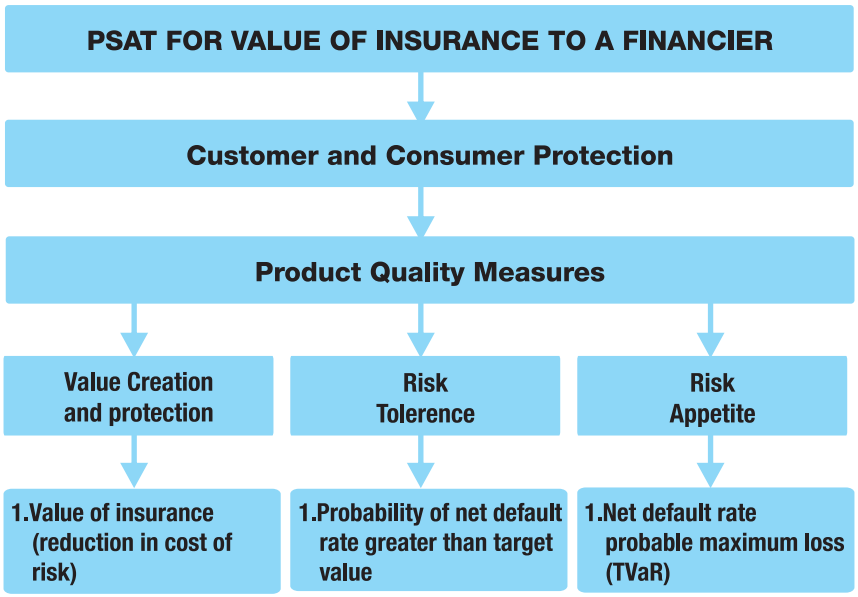
VALUE OF INSURANCE TO A FINANCIER

TOPIC 9: VALUE OF INSURANCE TO A FINANCIER

9.1. Introduction

- Financially sophisticated policyholders need to understand how insurance will alter their risk profiles.
- Highlighting how the cost of risk declines with insurance helps illustrate potential changes to the risk profile.
- The relationship between reduction in risk cost and premium rate depends on the risk aversion of the management team.
- The discussion below shows such an analysis.

9.2. PSAT diagram



9.3. Client information guidelines template

- From the PSAT diagram, a template for soliciting information from the client is developed.
- Feedback from the target client is used to complete this form.

Decision metrics	Client's guidelines
Value creation and protection	
Value of insurance (reduction in cost of risk)	
Risk tolerance	
Probability of net default rate greater than target value	
Risk appetite	
Net default rate probable maximum loss (TVaR)	
Gross premium rate	

Note: TVaR = tail value at risk.

9.4. Transactional and process controls

Step 1: Before risk modeling exercise, agree on the inputs and assumptions to be used for risk modeling exercise. (Don't waste time if you don't agree on assumptions and inputs.)

Step 2: After the risk modeling exercise, use the results and the applicable risk management committee guidelines to guide managerial decisions.

9.5. Practical application

Context: If your actuarial price is 5 percent, do you think the client would be interested in the product given the results of your modeling?

Activity: Using the risk management guidelines (Resource A), risk modeling results (Resource B), and the managerial and actuarial decision summary sheet (Resource C), evaluate this portfolio of products and determine the most sensible next step, documenting it in Resource C.

9.5.1 Resource A: Risk management guidelines

Decision metrics	Client's guidelines
Value creation and protection	
Value of insurance (reduction in cost of risk)	Greater than 2 percent
Risk tolerance	
Probability of net default rate greater than target value	Less than 5 percent
Risk appetite	
Net default rate probable maximum loss (TVaR)	Less than 4 percent
Gross premium rate	4 percent

Note: TVaR = tail value at risk.

9.5.2 Resource B: Risk modeling results—Product pricing	
GROSS DEFAULT RATE (NO INSURANCE)	
PROBABILITY OF GROSS DEFAULT RATE GREATER THAN TARGET	59%
EXPECTED GROSS DEFAULT RATE	4.42%
PROJECTED GROSS DEFAULT RATE FOR 1 IN 20 YEAR EVENT	7.81%
PROJECTED COST OF GROSS DEFAULT RISK	5.73%
NET DEFAULT RATE (WITH INSURANCE)	
PROBABILITY OF NET DEFAULT RATE GREATER THAN TARGET	0%
EXPECTED NET DEFAULT RATE	2.41%
PROJECTED NET DEFAULT RATE FOR 1 IN 20 YEAR EVENT	3.44%
PROJECTED COST OF NET DEFAULT RISK	3.08%
VALUE OF INDEX INSURANCE	
VALUE OF INDEX INSURANCE	2.65%

9.5.3 Resource C: Managerial and actuarial decision summary sheet		
Decision metrics	**Actuarial and managerial analysis**	
Value creation and protection		
Value of insurance		
Risk tolerance		
Probability of NPL value greater than target value		
Risk appetite		
Net default rate probable maximum loss (TVaR)		
Decision	Index insurance is a good solution for default risk	
	Index insurance is not a good solution for default risk	

Note: NPL = nonperforming loan; TVaR = tail value at risk.

TOPIC 10

RESERVING APPROACHES FOR NAMED PERIL INDEX INSURANCE PRODUCTS

TOPIC 10: RESERVING APPROACHES FOR NAMED PERIL INDEX INSURANCE PRODUCTS

10.1. Discussion questions for insurance industry leaders

- It is not uncommon to see a claims pattern like the one shown below for a weather index insurance portfolio. To be able to meet large claims when due, how should insurers reserve for this book of business? What reserving methods would you suggest be used?

Year	Annual net premium for retained account (Gross premium less expenses)	Annual triggered payouts
1	$200,000	0
2	$500,000	0
3	$500,000	0
4	$500,000	$800,000
5	$500,000	0
6	$500,000	0
7	$500,000	0
8	$500,000	0
9	$500,000	0
10	$500,000	$3,000,000

APPENDIX

DETAILED EXPLANATION OF KEY RISK METRICS

APPENDIX: DETAILED EXPLANATION OF KEY RISK METRICS

Product or project process	*Decision metric*	*What is it?*	*Why is it important?*	*How is it determined?*	*Acceptable values or range of values*
Base Index product evaluation	*Projected return period for inventory damage data*	The average period until the next time that inventory damage caused by the named peril occurs at specific damage levels (for example, damage to 10 percent of the inventory, 30 percent of the inventory, 50 percent of the inventory, and 70 percent of the inventory). The return period is the inverse of the frequency at which inventory damage happens at specific levels.	Tells the manager how often inventory damage occurs and helps the manager decide whether the event is an insurable one.	STEP 1: Create probabilistic model, for example, fit the adjusted inventory data to appropriate distributions. STEP 2: Generate 10,000 or more correlated scenarios from distributions in STEP 1. STEP 3: Specify inventory damage level of interest to you, for example, 50 percent. STEP 4: Determine number of scenarios in STEP 2 that are greater than the damage level specified in STEP 3. STEP 5: Return period = STEP 2 total divided by STEP 4 total.	The acceptable range of values is set through an internal managerial decision process. The lower the value of the return period, the higher the frequency of inventory damage and hence the higher the premium charged for this business should be.
	Projected return period for Base Index	The average period until the next time that the Base Index makes a payout at a specific payout level. This is the inverse of the frequency.	This metric tells the manager how often the Base Index pays out and helps the manager decide whether such a product meets management's expectations on payment frequency.	STEP 1: Create probabilistic model by fitting payout data to appropriate distributions. STEP 2: Generate 10,000 or more correlate scenarios from distributions in STEP 1. STEP 3: Specify payout ratio level of interest to you, for example, 50 percent. STEP 4: Determine number of scenarios in STEP 2 that are greater than the damage level specified in STEP 3. STEP 5: Return period = STEP 2 total divided by STEP 4 total.	For a good quality product, the Base Index return period should be as close as possible to the inventory damage return period because the former is being used to transfer losses caused by inventory damage. However, a close or perfect match in return periods does not necessarily mean that the base product will always trigger payouts at the correct times.

APPENDIX: DETAILED EXPLANATION OF KEY RISK METRICS

Product or project process	*Decision metric*	*What is it?*	*Why is it important?*	*How is it determined?*	*Acceptable values or range of values*
Base Index product evaluation	*Return period ratio*	A rough measure of how close the inventory and Base Index return periods are to each other.	This ratio tells the manager whether the proposed product has a payout frequency that is close to the frequency at which damage to inventory occurs.	Calculated as inventory damage return period divided by Base Index return period	Ideally this metric should be as close as possible to 1. A value greater than 1 shows that the product pays out more frequently than is required and less than 1 shows that the product at times fails to pay out at the specified damage level when expected to.
	Probability of Base Index not experiencing basis risk event	The probability of the product either triggering a payout when there is inventory damage caused by the named peril, or triggering no payout when there is no inventory damage due to the named peril.	This metric tells the manager how well the product matches inventory damage. Higher ratios mean the product does a better job in triggering payouts when expected to.	Compute the proportion of total scenarios when the Base Index triggers sufficient payouts against inventory damage scenarios. For a good quality product, the Base Index return period should be as close as possible to the inventory damage return period because the former is being used to transfer losses caused by inventory damage. However, a close or perfect match in return periods does not necessarily mean that the base product will always trigger payouts at the correct times.	Values close to 100 percent are best, but acceptable ranges around 100 percent can be set by management.
	Expected value of basis risk payments as a percentage of portfolio value	Average value of a basis risk amount expressed as a percentage of the total portfolio value.	An insurance manager should consider putting in place mechanisms or instruments for managing or transferring this risk and should know how big this risk is.	STEP 1: Using the probabilistic model, generate basis risk scenarios. STEP 2: Find average amount for those values greater than zero. STEP 3: Divide amount from STEP 2 by the value of the portfolio.	Depends on the risk tolerance of the management team and its confidence in tools used to manage the basis risk.

APPENDIX: DETAILED EXPLANATION OF KEY RISK METRICS

Product or project process	*Decision metric*	*What is it?*	*Why is it important?*	*How is it determined?*	*Acceptable values or range of values*
Base Index product evaluation	*Projected basis risk (TVaR)*	Average size of extreme basis risk amount that may be experienced during the risk period.	Gives manager an idea of how bad things could be in the worst-case scenario.	An average of those basis risk amounts that are considered to be in the tail of the basis risk amount distribution. For example, one could calculate an average of the top 5 percent of losses to give the TVaR. This would tell the risk manager how large basis risk could be in the worst 5 percent of years	Depends on the risk tolerance of the management team and its confidence in tools used to manage the basis risk.
Base Index product pricing	*Economic value added (EVA)*	A measure of how much value a product or portfolio contributes to the economic value of the firm.	• Tells the manager whether the addition of a product or portfolio of products will likely lead to the growth or erosion of firm value. A negative value indicates that the product is expected to erode firm value. If there are negative values, managers should ideally only accept this business if strategic reasons justify the negative value. An example could be that the business will be supported by other business with positive EVA from the same client. • Even if there are years when costs and payouts are higher than premium income, a manager who accepted business with positive EVA can demonstrate to senior management his or her efforts in building firm value.	STEP 1: Determine capital allocated to the product or portfolio (required capital) and calculate capital charge. STEP 2: Determine net increase in firm value as gross premium less (expenses + losses + capital charge). STEP 3: Determine scenario-level EVA as scenario net increase in firm value divided by required capital. STEP 4: Determine 5th percentile, expected value, and 95th percentile value of the EVA.	In principle, only products with a positive EVA should be accepted.

APPENDIX: DETAILED EXPLANATION OF KEY RISK METRICS

Product or project process	*Decision metric*	*What is it?*	*Why is it important?*	*How is it determined?*	*Acceptable values or range of values*
Base Index product pricing	*Sharpe ratio*	This metric allows management to understand how much value is created per unit of risk. It is also called the reward-to-variability ratio and allows management to compare investments with different risk profiles by understanding which investments provide more excess return per unit of risk.	Although insurance firms aim for positive returns on their capital, offering index insurance products also comes with risk. The Sharpe ratio is a useful metric that allows management to compare (and rank) investments with different expected returns and risk profiles.	Sharpe ratio = (expected return on capital – risk-free rate) divided by standard deviation of the return on capital.	The higher the Sharpe ratio, the more favorable an investment. An important function of the Sharpe ratio is to compare (or rank) investments in alternative products.
	Combined ratio	The combined ratio is a measure of the proportion of the premiums that will be spent on expenses and payouts.	Management needs to understand whether premiums are expected to be sufficient to cover expenses and payouts.	Combined ratio = loss ratio + expense loading. The profit margin is equal to 100 percent minus the combined ratio.	Lower combined ratios are preferable. In general, only products with combined ratios of less than 100 percent are acceptable.
	Probability of ruin	This metric indicates the probability that the capital fund available to cover the product risk will be exhausted over a specified timeframe.	Management needs to understand whether this probability is (too) high so that it can either increase the capital funds available, decrease the risk of the product, or increase the premiums.	STEP 1: Create probabilistic model, generate 10,000 or more correlated scenarios. STEP 2: Determine number of scenarios in STEP 1 in which the value of the capital fund is less than zero. STEP 3: Probability of ruin = STEP 2 total divided by STEP 1 total.	Lower probabilities of ruin are preferable.
	Probability of negative profit	This metric indicates the probability of a loss (that is, negative profit) from the product over a certain period, for example, a year or a season.	The probability of a loss over a certain period is an important measure of risk.	STEP 1: Create probabilistic model, generate 10,000 or more correlated scenarios. STEP 2: Determine number of scenarios in which profits are negative. STEP 3: Probability of negative profits = STEP 2 total divided by STEP 1 total.	Lower probabilities of negative profits are preferable. This metric should be viewed in conjunction with other variables.

APPENDIX: DETAILED EXPLANATION OF KEY RISK METRICS

Product or project process	*Decision metric*	*What is it?*	*Why is it important?*	*How is it determined?*	*Acceptable values or range of values*
Base Index product pricing	*Probability of profit below target*	This metric is very similar to the probability of negative losses, except this probability is for a specific profit level. For example, the firm may have set a target profit of $1,000,000, so the metric would be the probability of profits being below the $1,000,000 target level.	A measure that quantifies the chance of failing to meet the profit target is important when evaluating options for investing shareholder capital.	STEP 1: Create probabilistic model, generate 10,000 or more correlated scenarios. STEP 2: Determine number of scenarios in which profits are below set target. STEP 3: Probability of profit below target = STEP 2 total divided by STEP 1 total.	Lower probabilities of profits below targets are preferable. This metric should be viewed in conjunction with other variables.
Redesigned Index product evaluation	*Projected return period for the Redesigned Index*	The average period until the next time that the Redesigned Index makes a payout at a specific payout level.	See description of the Base Index on why this metric is useful and how it is calculated.		
	Return period ratio	**See description in Base Index product evaluation section of this table.**			
	Percentage of years when there is no implied deductible	This metric is the probability for each year that the product does not have an implied deductible.	Management needs to understand how often (that is, the proportion of years) the product will have no implied deductible.	STEP 1: Create probabilistic model, generate 10,000 or more correlate scenarios. STEP 2: Determine number of scenarios in which there is no implied deducible. STEP 3: Probability of no implied deductible = STEP 2 total divided by STEP 1 total.	The greater this probability, the better the redesigned index is. However, this is just one of many metrics that can be used to evaluate the Redesigned Index.
	Expected value of Redesigned Index implied deductible as percentage of portfolio	This metric along with the TVaR of the implied deductible indicate how large the implied deductible is expected to be (that is, its expected value) and how large it can be (TVaR).	It is important for management to understand how large the implied deductible is with the Redesigned Index versus the Base Index.		
	TVaR of Redesigned Index implied deductible as percentage of portfolio	**See Projected basis risk (TVaR) in Base Index product evaluation section of this table.**			

APPENDIX: DETAILED EXPLANATION OF KEY RISK METRICS

Product or project process	*Decision metric*	*What is it?*	*Why is it important?*	*How is it determined?*	*Acceptable values or range of values*
Detailed market analysis					
	Economic value added	**See description in Base Index product pricing section of this table.**			
	Sharpe ratio	**See description in Base Index product pricing section of this table.**			
	Combined ratio	**See description in Base Index product pricing section of this table.**			
	Probability of negative profit	**See description in Base Index product pricing section of this table.**			
	Probability of profit below target	**See description in Base Index product pricing section of this table.**			
Value of insurance to a financier	*Value of insurance*	This is the reduction in the cost of risk to the financier that is achieved by transferring away part of the risk to an insurer.	Illustrates whether an insurance contract has any effect on the financier's risk level. A good product significantly reduces the total cost of risk. A client may not want to pay much more than the reduction in the cost of risk, so if the premium being charged and the value of insurance are very different, most clients would decide to retain the risk. Only very risk averse clients might buy when the value of insurance is substantially lower	Cost of gross retained risk without insurance less cost of retained risk with insurance.	No specific range but the higher the better.
	Probability of net default rate greater than target	The chance of debt risk exceeding a set target.	A significant reduction in this probability shows that the insurance has limited the chance of the default rate exceeding management's risk tolerance levels.	STEP 1: Create probabilistic model, generate 10,000 or more correlated scenarios. STEP 2: Determine number of scenarios in which net default rates are greater than target. STEP 3: Probability of net default rate greater than target = STEP 2 total divided by STEP 1 total.	
		Net default rate probable maximum loss (TVaR) should be defined.			

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