

CHAPTER – III

THEORETICAL FRAMEWORK OF RISK MANAGEMENT IN AGRICULTURE

3.1 RISK MANAGEMENT IN AGRICULTURE

3.1.1 Introduction

Risk Management in agriculture is a mechanism to protect farmers and other stake holders against the uncertainties of agricultural production that arises due to the natural factors beyond the control of farmers. It is also a financial mechanism in which the uncertainty of loss in agricultural yields is minimized by pooling most uncertainties that impact agricultural yields, so that the burden of loss can be distributed.

Agricultural production involves numerous risks - natural, social, economic and personal. However, the principal characteristic, which distinguishes agricultural production from any other activity, is its great dependence on nature. Agricultural production unlike almost any other activity has to be carried on in the face of continual uncertainties arising out of diverse natural and social elements.

3.1.2 Risks in Agriculture

Agricultural risk is associated with negative outcomes that stem from imperfectly predictable biological, climatic, and price variables. These variables include natural adversities (for example, pests and diseases) and climatic factors not within the control of the farmers. They also include adverse changes in both input and output prices.

To set the stage for the discussion on how to deal with risk in agriculture, it's essential that the different sources of risk that affect agriculture are classified¹.

Types of Risk

(i) Production risk:

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

Production Risk is the most important factor in agricultural insurance. Therefore, it has been analyzed separately.

(ii) Price or Market risk:

Input and output price volatility is the important source of market risk in agriculture. Prices of agricultural commodities are extremely volatile. Output price variability originates from both endogenous and exogenous market shocks. Segmented agricultural markets will be influenced mainly by local supply and demand conditions, while more globally integrated markets will be significantly affected by international production dynamics. In local markets, price risk is sometimes mitigated by the “natural hedge” effect in which an increase (decrease) in annual production tends to decrease (increase) output price (though not necessarily farmers’ revenues). In integrated markets, a reduction in prices is generally not correlated with local supply conditions and therefore price shocks may affect producers in a more significant way. Another kind of market risk arises in the process of delivering production to the marketplace. The inability to deliver perishable products to the right market at the right time can impair the efforts of producers. The lack of infrastructure and well-developed markets make this a significant source of risk.

(iii) Financial & Credit risk:

The ways businesses finance their activities is a major concern for many economic enterprises. In this respect, agriculture also has its own peculiarities. Many agricultural production cycles stretch over long periods of time, and farmers must anticipate expenses that they will only be able to recuperate once the product is marketed. This leads to potential cash flow problems exacerbated by lack of access to insurance services, credit and the high cost of borrowing.

(iv) Institutional Risk:

Another important source of uncertainty for farmers is institutional risk, generated by unexpected changes in regulations that influence farmers' activities. Changes in regulations, financial services, level of price or income support payments and subsidies can significantly alter the profitability of farming activities. This is particularly true for import/export regimes and for dedicated support schemes, but it is also important in the case of sanitary regulations that can restrict the activity of producers and impose costs on producers.

(v) Resource risk:

The resource risks include uncertain supply or non-availability of labour (skilled labour), credit and irrigation water and also timely supply of desired seed, fertilizer or plant protection chemicals. Supply of spurious seeds and plant protection chemicals pose a great risk to the producers. Failure of crops due to sub-standard seed or spurious plant protection chemicals causes drain of resources of the farmer. It inflicts considerable damage on the psyche of the farmer some times leading to suicides by the farmers.

(vi) Technology risk:

Like most other entrepreneurs, farmers are responsible for all the consequences of their activities. Adoption of new technologies in modernizing agriculture such as introduction of genetically modified crops causes an increase in producer liability risk.

(vi) Personal (Health and Asset) risk:

Finally, agricultural households, as any other economic entrepreneur, are exposed to personal risks affecting the life and the wellbeing of people who work on the farm, as also asset risks from floods, cyclones and droughts and possible damage or theft of production equipment and any other farming assets.

3.1.3 Risk Management Strategies:

In discussing how to design appropriate agricultural risk management policies it is useful to understand strategies and mechanisms used by producers to deal with risk. It is also necessary to distinguish between informal and formal risk management mechanisms and between ex ante and ex post strategies. As highlighted in the 2000-2001 World Development Report², informal strategies are identified as “arrangements that involve individuals or households or such groups as communities or villages,” while formal arrangements are “market-based activities and publicly provided mechanisms.” The ex-ante or ex-post classification focuses on the point in time in which the reaction to risk takes place: prior to the occurrence of the potential harming event (ex-ante) or after the event has occurred (ex-post). Among the ex ante reactions, it can also be useful to highlight the differences between on-farm strategies and risk-sharing strategies.

According to Walker and Jodha (1986)³, the ex-ante and ex-post strategies can also be grouped as risk-reducing and risk-coping strategies. The ex-ante measures adopted to lower or minimise risks can be grouped as risk-reducing strategies whereas ex-post measures adopted to mitigate risks are classified as risk-coping measures or strategies. **Figure – 3.1** exhibits these classifications.

Figure – 3.1
Risk Management Strategies in Agriculture

		<i>Informal Mechanisms</i>	<i>Formal Mechanisms</i>	
			<i>Market based</i>	<i>Publicly provided</i>
Ex-Ante Strategies	<i>On-farm</i>	<ul style="list-style-type: none"> • Avoiding exposure to risk • Crop diversification and inter-cropping • Plot diversification • Mixed farming • Diversification of income source • Buffer stock accumulation of crops or liquid assets • Adoption of advanced cropping techniques (fertilization, irrigation, resistant varieties) 		<ul style="list-style-type: none"> • Agricultural extension • Supply of quality seeds, inputs, etc. • Pest management systems • Infrastructures (roads, dams, irrigation systems)
	<i>Sharing risk with others</i>	<ul style="list-style-type: none"> • Crop sharing • Sharing of agricultural equipment, irrigation sources, etc • Informal risk pool 	<ul style="list-style-type: none"> • Contract marketing • futures contracts • Insurance 	
Ex-Post Strategies	<i>Coping with shocks</i>	<ul style="list-style-type: none"> • Reduced consumption patterns • Deferred / low key social & family functions • Sale of assets • Migration • Reallocation of labor • Mutual aid 	<ul style="list-style-type: none"> • Credit 	<ul style="list-style-type: none"> • Social assistance (calamity relief, food-for-work, etc) • Rescheduling loans • Agricultural insurance • Relaxations in grain procurement procedures • Supply of fodder • Cash transfer

Source: Constructed from 2000/2001 World Development Report (World Bank 2001)

(i) Informal mechanisms:

Ex-ante informal strategies are characterized by diversification of income sources and choice of agricultural production strategy. One strategy producers can employ is simply to avoid risk. In many cases, extreme poverty makes people very risk averse, often avoiding activities that entail risk but that could also bring larger income gains. This inability to manage risk and accumulated and retention of wealth is sometimes referred to as the "the poverty trap".

Once farmers have decided to engage in farming activities, the production strategy selected is an important means of mitigating the risk of crop failure. Traditional cropping systems in many places rely on crop diversification and mixed farming. Crop diversification and intercropping systems are the means to reduce the risk of crop failure due to adverse weather events, crop pest or insect attacks. From the present studies it is evident that those households whose consumption levels are close to subsistence (and are therefore highly vulnerable to income shocks) devote a larger share of land to safer, traditional varieties of rice and other cereals than to riskier, high-yielding varieties.

Apart from altering agricultural production strategies, households also show smooth income by diversifying income sources and thus minimizing the effect of a negative shock to anyone of them. According to the study conducted by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)⁴, most rural households in villages of semi-arid India surveyed to generate income from at least two different sources; typically crop income and some livestock or dairy income. Off-farm seasonal labor, trade and sale of handicrafts are also common income sources. The importance of income source diversification as part of risk management is emphasized by many studies, finding that households with more farm profit volatility are more likely to have a household member engaged in steady wage employment.

Buffer stock accumulation of crops or liquid assets, and the use of credit present obvious means for households to smooth consumption. Studies also show that currency and crop inventories function as buffers or precautionary savings.

Crop-sharing arrangements in land renting and labor hiring can also provide an effective way of sharing risks between individuals, thus reducing producer risk exposure. Other risk sharing mechanisms, such as community-level risk pooling, occur in specific communities or extended households where members of the group transfer resources among themselves in order to rebalance marginal utilities. These kinds of arrangements are effective for counterbalancing consequences of events that affect some members of the community, but do not work well in cases of covariate income shocks.

Ex-post informal income-smoothing mechanisms are typically the sale of assets, such as land or livestock, or reallocation of labor resources to off-farm labor activities, deferred / low key family functions, reduced consumption patterns, migration. It is reported in studies that southern Indian farmers are able to quickly shift from 100 per cent on-farm labor activities to largely off-farm activities if the monsoon rains are expected to be poor.

The need to smooth consumption not only against idiosyncratic shocks, but also against correlated shocks comes at a serious cost in terms of production efficiency and reduced profits, thus lowering the overall level of consumption of the household. A major consideration for innovation would be to shift correlated risk from rural households. An obvious solution is for rural households to engage in risk sharing with households or institutions from areas largely uncorrelated with the local risk conditions.

Examples of such extra-regional risk sharing systems are found in the literature⁵, for example, through credit and transfers with distant relatives; through migration and marriages; or through ethnic networks.

Although there is some degree of risk sharing and thus of insurance against weather, none of the systems are so widespread that they cover all households, nor are they even close to providing a fully efficient insurance mechanism. Most households are therefore still left with no insurance against correlated risks, the main source of which is weather.

(ii) Formal mechanisms:

Formal risk management mechanisms can be classified as publicly provided or market based (Figure – 3.1). Government action plays an important role in agricultural risk management both ex ante and ex post. Ex ante education and services provided by agricultural extension help to familiarize producers with the consequences of risk and help them in adopting strategies to deal with risk. Supply of quality agricultural inputs is another institutional strategy. Governments also reduce the impacts of risk by developing relevant infrastructure and by adopting social schemes and cash transfers for relief after shocks have occurred⁶.

As mentioned earlier, production and market risks probably have the largest impact on agricultural producers. Various market-based risk management solutions have been developed in order to address these sources of risk⁷.

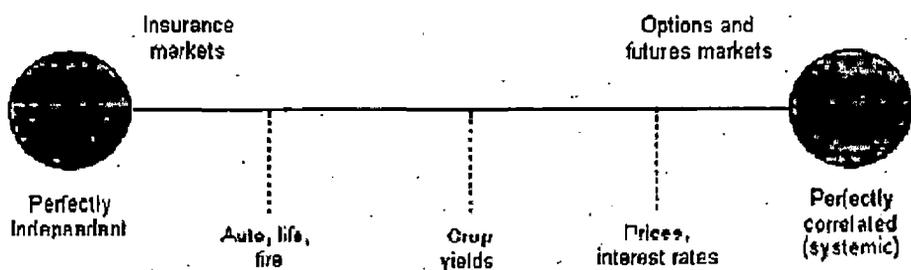
(a) Production/Weather Risk Management

Insurance is another formal mechanism used in many countries to share production risks. However, insurance is not as efficient in managing production risk as derivative markets are for price risks.

Price risk is highly spatially correlated and, as illustrated by Figure – 3.2 below futures and options are appropriate instruments to deal with spatially correlated risks. In contrast, insurance is an appropriate risk management solution for independent risks. Agricultural production risks typically lack sufficient spatial correlation to be effectively hedged using only exchange-traded futures or options instruments. At the same time, agricultural production risks are generally not perfectly spatially independent and therefore insurance markets do not work at their best.

Experts refer to these risks as “in-between” risks. According to economists, “good or bad weather may have similar effects on all farmers in adjoining areas” and, consequently, “the law of large numbers, on which premium and indemnity calculations are based, breaks down.” In fact, positive spatial correlation in losses limits the risk reduction that can be obtained by pooling risks from different geographical areas. This increases the variance in indemnities paid by insurers. In general, the more the losses are positively correlated, the less efficient traditional insurance is as a risk-transfer mechanism.

Figure – 3.2
Independent Versus Correlated Risk



(Source: Managing Agricultural Production Risk – Innovations in Developing Countries, the World Bank (2005))

(b) Price Risk Management

One way producers have traditionally managed price variability is by entering into pre harvest agreements that set a specific price for future delivery. These arrangements are known as forward contracts and allow producers to lock in a certain price, thus reducing risk, but also foregoing the possibility of benefiting from positive price deviations. In specific markets, and for specific products, these kinds of arrangements have evolved into futures contracts, traded on regulated exchanges on the basis of specific trading rules and for specific standardized products. This reduces some of the risks associated with forward contracting (for example, default).

A further evolution in hedging opportunities for farmers has been the development of price options that represent a price guarantee that allows producers to benefit from a floor price but also from the possibility of taking advantage of positive price changes. With price options, agents pay a premium to purchase a contract that gives them the right (but not the obligation) to sell futures contracts at a specified price. Futures and options contracts can be effective price risk management tools. They are also important price discovery devices and market trend indicators.

The traditional risk coping strategies are effective in addressing idiosyncratic risks like accident, theft etc., as these are independently distributed across the people. Traditional risk-coping mechanisms cannot deal effectively with the co-variability problem.

For example, financial assistance in the form of transfers or loans from relatives and friends may not come forth as production and price risks affect nearly all the farmers simultaneously within a small rural community. Similarly, borrowing for consumption is costly when risk affects large population in the area. Lack of tangible assets makes informal credit more popular among the poor.

Liquidation of assets also fetches low price during crisis as number of farmers tries to sell at the same time. However, replenish/replacement of assets takes time after the catastrophic event as prices are jacked up through mutual competition. Agricultural insurance institutions are expected to provide more efficient risk management tools to deal with both idiosyncratic as well as systemic or covariate risk faced by the farming community.

Agriculture Insurance absorbs the shock of crop failure by providing cushion wherein farmer is assured of minimum protection against various natural calamities. Moreover, crop insurance provides right to seek compensation rather than requesting for gratis from the government in the event of crop failures. Thus, crop insurance will help to maintain the dignity of the farmer. Even in the years of crop failures, crop insurance assures farmers decent living from their own efforts and not by charity.

3.2 NEED FOR AGRICULTURAL INSURANCE

In continuation with chapter 3.1, it is quite evident that the most substantial form of agricultural risk management applied in the contemporary financial system all across the world is agricultural insurance. The major role played by agricultural insurance programmes is the indemnification of risk-averse individuals who might be adversely affected by natural probabilistic phenomenon.

The farmer's main goal is to sell his production surplus and maximize his profits, which is surplus over and above his investment. In order to augment profit, the farmer has to increase his production/marketable surplus. In order to increase output, necessary investments have to be made in inputs. These could be both long-term; as in land leveling or development of irrigation, and short-term such as crop loans for purchasing seeds, fertilizers and pesticides. Farming or crop production being a biological process, converting input into output carries the greatest risk in farming. This, coupled with market risk, impinges on the profits expected from farming.

Agricultural (crop) insurance brings in security and stability in farm income. Crop insurance is based on the principle of large number. The risk is distributed across space and time. The losses suffered by farmers in a particular locality are borne by farmers in other areas or the reserves accumulated through premiums in good years can be used to pay the indemnities. Thus, a good crop insurance programme combines both self as well as mutual help principle.

3.2.1 Growth in Demand for Agricultural Insurance

The expected growth in demand of agricultural insurance has its origins in changes in the farming sector. Powerful influences are categorized below and discussed briefly in this section⁸.

- ❖ Evidence is accumulating of connections between climate change, and the increasing incidence of **crop-damaging weather events** of extreme severity.
- ❖ Farming is becoming steadily more **commercialized**, with greater levels of financial investment. As a part of this trend to commercialization greater use is now being made of contract farming arrangements, where insurance is one of many services provided, along with inputs, to growers. In summary, there is a trend to formalize risk management in farming, with insurance being one obvious mechanism which can be harnessed for this task.
- ❖ The **World Trade Organization (WTO)** regulations generally forbid governments from subsidizing agriculture directly; however, they permit the subsidization of agricultural insurance premiums. For those countries wanting and able to effect transfer payments into their farming sectors, insurance provides a convenient channel for doing so. In the face of this WTO regulation, it is clear that demand for crop insurance will increase in those economies that wish to implement a policy of permitted subsidization of their farmers.

The apparently diverse influences have a major common theme. This is that any insurance arrangement will involve not only the farmer and the insurer, but also important third parties. Consideration is now given to these changes to the business of farming, and to how they have increased demand for crop insurance, or might be expected to do so in the future.

(i) Increasing Incidence of Crop Damaging Weather Events

One major reinsurer has calculated that the economic losses (adjusted for inflation) of weather-related events in the period 1985-1999 amounted to some US\$707 billion. Over a longer period, 1950-1999, the average annual losses (again adjusted for inflation) have increased by more than ten times, while the global population has increased by a factor of 2.4⁹. While crop and forest losses are only a part of this, the same reinsurer estimates that the costs associated with crop damaging weather events are doubling each decade.

The scientific community is not unanimous in attributing the increases in extreme weather events to global warming. However, there is a strong body of opinion which holds that this is the case. A consequence of global warming is a rise in the frequency and magnitude of extreme weather events. This is considered as major cause of the increases in losses noted in the previous paragraph.

The increasing incidence of crop damaging weather events is likely to continue to push demand for insurance coverage of losses. At the same time the insurance industry is mindful of increasing exposures, and is exploring new financial instruments to assist in managing this exposure.

(ii) Greater Commercialization of Farming/ Contract Farming

Implementation of technology in farming usually involves investment. Such changes also frequently alter the risk profile of the enterprise. A common example is in minor irrigation. The availability of low cost pump sets has greatly increased the productivity of small farms in much of rural India, and has brought a boom in irrigated vegetable production in semi-arid areas of the Middle East, for example in Syria. But in both areas there is now vulnerability to falling water table levels¹⁰.

Investor/farmers who have a substantial interest in the success of a given crop are likely to have loan from a bank in order to make the necessary investment. Banks with a heavy concentration of loan assets in farming face the prospect of substantial losses through systemic risk – i.e., risk that affects many at the same time. An example is unfavorable weather conditions over a wide geographical area. In both cases, i.e. borrower and lender, there is an interest in managing the risk of crop failure through the most economic means. There are occasions when insurance can be a key component in a range of risk management strategies.

This type of link between crop insurance and loans is already been a very common features both in developing and developed agriculture. The vast, heavily subsidized scheme in India is largely linked to bank lending¹¹.

From an administrative point of view bank/insurer linkages make a lot of sense. Since both of these providers of financial services require similar client data. Moreover a bank can readily act as an agent for selling insurance. This means significant cost savings in obtaining data and in making financial transactions (payment of premiums and paying-out indemnities). The impetus for the further development of contract farming has come from the increasing number of fast food outlets, the growing role of supermarkets, and the continued expansion of world trade in fresh and processed products.

In contract farming both the grower and the buyer expect to benefit financially from a crop which is up to normal expectations in terms of both quantity and quality. Both therefore have an "insurable interest". This means that an insurance product could be structured so that each party receives an indemnity in the event of an insured loss. It is quite inevitable that insurance protection could be arranged against major weather perils as part of the contractual arrangement.

(iii) World Trade Organization (WTO) Regulations

One of the policy-making priorities of governments is to facilitate trade. For most developing countries agricultural exports are important, and it is vital therefore, that WTO's regulations are respected. Subsidization of crop insurance premiums is permitted by the WTO. They are considered as falling into the 'Green Box' of measures by which a government can support its producers. Whereas this development is still relatively new, the commercial insurance industry has experienced an upsurge in demand for information, from governments, on crop insurance. [The insurance clause was part of the Agreement signed in Marrakech in 1994 and implemented from 1 January 1995.]¹²

There are several types of assistance by which a government can facilitate crop insurance. Among these are the following¹³:

- Provision of information on weather patterns, incidence of perils, evidence of past losses following adverse weather events, numbers, areas and locations of farms/crops, historical crop yields (data and trends). Most countries do this on a regular basis.
- Meeting the costs of the research needed before any crop insurance programme can be started. Often this responsibility is shared by development organizations such as FAO – e.g., in the case of Pakistan in 1995 and Syria in 2000, and the World Bank – e.g., in the case of Morocco in the late 1990s.

- Subsidization of premiums payable by farmers. This is very common, with Canada, Cyprus, India, Japan, the Philippines and the United States being examples.
- Providing a layer of reinsurance. Although less common than premium subsidy, it is practiced, for example, in the United States, Cyprus and India.

Efficient risk reducing and loss management strategies such as crop insurance would enable the farmer to take substantial risks without being exposed to hardship. Access to formal risk diffusing mechanisms will induce farmers to maximize returns through adoption of riskier options. Investment in development of groundwater, purchase of exotic breeds for dairy will be encouraged due to insurability of the investment. This will help the individual to augment and increase the farm income (micro perspective) and also help to augment aggregate production in the country (macro perspective). The benefits of crop insurance should not be considered from an insurance business point of view but also from socio-economic perspective.

3.2.2 Benefits of Crop Insurance

Overall benefits of Crop Insurance could be summarized as follows:

1. Crop Insurance cushions the shock of disastrous crop loss by assuring farmers a minimum of protection.
2. As agricultural income is an important factor in national income, crop insurance also has an effect on the prosperity of the country. It gives farmers greater confidence, in making greater investments in agriculture.
3. It improves the position of farmers in relation to agricultural credit.
4. Government is relieved of present uncertain financial burden of providing relief.
5. It can help in normalizing the availability of supplies and stabilize prices.
6. It will help to maintain the dignity of farmers.
7. It enables to maintain the systematic records of crop production.

3.3 BASIC PRINCIPLES OF AGRICULTURAL INSURANCE

3.3.1 Traditional Philosophies of Agricultural Insurance

From the very inception of agricultural insurance industry crop insurance pursue some universal doctrines. These are discussed below¹⁴.

“There must be a large number of exposure units:”

Pooling involves the grouping of a large number of roughly homogeneous, independent exposure units so that the law of large numbers can provide an accurate prediction of average future losses. Lack of proper classification system results in *adverse selection* and only the higher risk members will participate in the pool.

“Accidental and Unintentional Loss:”

Losses must occur as a result of chance -- an ‘act of God’ rather than an ‘act of management.’ Moral hazard occurs when insured change their behavior after they purchase insurance. The behavioral change increases the likelihood that policyholders will collect insurance indemnities and ultimately results in prohibitively high insurance premiums.

“No Catastrophic Loss:”

If losses are positively correlated across insurance units (i.e., the underlying risk is systemic) the law of large numbers does not apply. Annual losses for the insurance pool will be extremely variable. The loss in any given year may be large enough to threaten the solvency of the insurance pool. Two techniques for insuring correlated losses are reinsurance and geographical spreading so that catastrophe insurance exposure is limited in any given geographical market.

“Calculable Chance of Loss:”

To develop a premium rate, one must be able to estimate both average frequency and average severity of loss. Low probability, high consequence catastrophic risks present serious challenges in premium rate-making.

“Economically Feasible Premium:”

Premiums must be affordable. The chance of loss must be in a range that does not result in extremely high premiums. At some high level of probability the loss becomes a standard business expense instead of a risk to be transferred. While the chance of loss must not be too high, the potential for loss must be economically significant. Otherwise there will be no demand.

3.3.2 Principles of Agricultural Insurance

Not all risks are insurable. To be insurable, a risk must satisfy the following main criteria¹⁵:

- ❖ The probability of a loss in the future, should lend itself to estimation. This is possible only if reliable data of losses is available for a long period in the past.
- ❖ The loss must be capable of being estimated in financial terms.
- ❖ The probability of event should not be too high, to make insurance unaffordable
- ❖ Occurrence of an event, or the damage it causes, should not be affected by the insured's behavior (Moral Hazard) i.e., agricultural insurance should only cover insurable risks and not risks created by poor management.
- ❖ To the extent possible, the risk should be an 'Independent Risk'.

3.3.3 PREREQUISITES OF AN IDEAL AGRICULTURAL CROP INSURANCE PRODUCT

An ideal crop insurance product/ scheme should possess the following traits¹⁶.

- ✓ Assuring farmers a minimum protection from a disastrous crop loss.
- ✓ Generating greater confidence in the mind of the farmers to make more investments in agriculture.
- ✓ Be capable of bringing into its fold more crops and different sections of farmers.
- ✓ Ensuring substantial market penetration by suitable functional strategies.
- ✓ Formulating separate schemes to cater to the needs and requirements of farmers in different kinds of terrain.
- ✓ Relieving the Government from the unexpected financial burden.
- ✓ Improving the agricultural credit position of farmers.
- ✓ Maintaining the dignity of farmers.
- ✓ Normalizing the availability of supplies and stabilize prices.
- ✓ Enabling maintenance of systematic records of crop production and crop losses.
- ✓ Ensuring Government support to meet the subsidy component of the premium while ensuring noninterference in claim settlement to conduct the business on professional lines.
- ✓ Ensuring adequate Reinsurance protection.
- ✓ Ensuring voluntary participation by properly highlighting the need, advantages and procedures involved in a clear and transparent manner.
- ✓ Using the services of Financial Institutions, Marketing agencies; Agriculture Universities, Agro research centers and other Non Governmental Organizations according to their respective roles to build database, to reduce costs and to propagate the need for insurance protection.
- ✓ Utilizing local skills, material and indigenous technical knowledge and also promoting participatory research for prudent underwriting

3.4 DEVELOPMENT PROCESS OF AGRICULTURAL INSURANCE

Any decision-making process on agricultural insurance involves many stages. These stages and certainly the priorities will differ from different entities depending on which type of body is doing the investigation. This may be a government ministry, a farmers' organization, an insurer, a bank or a group of marketing/processing agencies. In any case, some of the major important issues and steps are¹⁷:

- 1. Demand Assessment** – ensuring that any initiatives are in response to real risk management needs;
- 2. Identification of the key insured parties** – automatic or voluntary cover;
- 3. Determination of key perils** – a key factor in insurance design;
- 4. Decision on crops to be covered** – another key factor in insurance design;
- 5. Analysis of insurance options** – loss assessment issues;
- 6. Rating** – determining overall Insurance Administration;
- 7. Identification of possible complementary roles of the Government and private sector.**

In any given situation the results of investigating these issues will determine whether or not agricultural insurance is the most efficient and effective mechanism to manage a particular area of risk. The results will also indicate the type of insurance product which is optimum for a given situation.

3.4.1 Demand Assessment

This must come first, but is always difficult, as before a detailed investigation of the incidence and effect on crops of perils, and an assessment of operating costs, it is impossible to give more than a very vague estimate of the likely cost of the insurance. Unless farmers know the details of the product and its price, they are not likely to indicate whether or not they will buy.

Closely linked to this is the need for any agricultural insurance programme to respond to real needs. It is to be noted that, crop insurance is a business, and both parties must want to participate. Real needs must be met for this condition to be satisfied.

These needs are changing, as new opportunities arise. An example comes from the increasingly accepted (and, often, trade-mandated) policy to reduce of the use of certain crop pesticides. In order to overcome growers' fears that alternative and safer techniques and products could be used, insurance has a potentially important, if temporary, role to play.

In the face of these needs, the services of an experienced agricultural insurance team are required when crop insurance is under consideration. Such a specialist team would be able:

- ✓ To examine the risk structure of certain key crop sectors;
- ✓ To identify the extent to which the involved parties are vulnerable to these risks;
- ✓ To draft an outline of an insurance programme, with indicative costs and benefits, and responsibilities; it would also include details of further investigative, publicity and lobbying work required before insurance business could commence.

This team would consult closely with several sectors in the economy, and follow up in detail the issues which are described below.

3.4.2 Nature of the Insured Parties – Automatic or Voluntary Covers

Farmers are one obvious party to crop insurance. Those who depend on a supply of farm produce for their business are another. The latter group includes processors and crop product buyers. These firms often stand to lose financially if crop product is not available from their local farmer suppliers. In this case they may face increased product acquisition costs and they therefore have an insurable interest in the growing crops.

One of the important factors may be stated as leading to an increased demand for crop insurance is the growth of contract farming arrangements. When insurance can economically address some of the production risk involved, risk which affects both growers and contractors, then there may be a case for making crop insurance automatic. This is the same as making it compulsory, but “automatic” is a better description of the process when insurance becomes just one of a range of services being provided, as a package, to contracted growers.

3.4.3 Determination of Key Perils

Determination of key perils or threats in agricultural is the most important factor in Risk Management process. A listing of key perils and risks for agriculture across the world would be long. For the present purposes it is useful to focus on those which are of major concern to developing countries. Further, they can be clustered into a number of groups. One such clustering would produce a list as follows¹⁸:

- ❖ Production risks
- ❖ Natural resource risks
- ❖ Financial risks
- ❖ Marketing and price risks

Production and natural resource risks are relevant to this discussion of crop insurance. Therefore, these have been discussed in greater detail. Financial and marketing/price risks fall outside the scope of the present study. Considering the importance of production and natural resource risks in agricultural insurance it has been extensively discussed in a different chapter.

3.4.4 Decision on which crops to be insured

The 'Benefit/Cost Issues' in most of the production processes can arise a paradoxical situation. Virtually any crop can be insured against virtually any peril, but only at a price. The tight margins in agriculture production highlight the need for risk management, including insurance, but also reduce the ability of growers to buy the desired level of protection.

The discussion below will focus on four main groups of crops¹⁹, (a) annual field crops, (b) perennial crops (including horticultural tree crops), (c) glasshouse crops and finally, (d) forests. The focus will be on identifying those areas of risk which the nature of the crop, and of its common perils that could predispose for insurance as part of a risk management strategy.

In this discussion, 'crop insurance' relates to the various types of contract which make up the more traditional type of cover, as opposed to index policies. With the latter, the nature of the crop is not an issue, since the insurance contract relates just to a given weather event.

One of the factors which can determine whether or not a particular crop/peril combination is suitable for insurance is the ease and economy by which losses can be satisfactorily assessed.

This issue will be touched on below, with some of the more general loss assessment issues discussed in greater detail under the section, Loss Assessment.

(i) Annual Field Crops

Wheat, maize, rice, soybeans, sorghums, cotton, beans etc. are all insured in various parts of the world. As annuals, any loss or damage is just to one season's crop – unlike for perennial crops and forests. As a general rule, the more commercial the nature of the crop, the greater will be both the potential demand for insurance, and the likelihood of a cost-effective role for crop insurance in risk management. Crops of the high value input – high value output variety are often financed with the assistance of banks, and lenders increasingly insist on insurance coverage, when this is available.

Another important issue in commercial crop production is the marketing chain. With crops such as sugar cane, coffee, tea and cotton, virtually all of the harvested production enters the commercial market, and requires processing. This means that there is control over quantities produced, year after year, together with an opportunity for establishing a strong database of producers and of details of production enterprises. Information management of this sort is vital to create the climate of confidence necessary for efficient and economical insurance transactions.

It will be evident from the above that food crops, especially those for which there is an active, unrecorded local market, are difficult to trace after harvest. This means that insurance assessments are similarly difficult for this type of crop.

(ii) Perennial Crops

Perennial crops pose a special problem. In the occurrence of a loss event, should the loss be calculated solely on the basis of the current season's expected production, or should reduced production levels for the next season(s) be included?

The difficulty of making accurate assessments for future years will be evident and crop insurers in Chile and Cyprus, for example, include only the current season's production losses. On the other hand, when a peril such as windstorm causes serious damage to tree crops such as oil palm, coconut, rubber, and mango or to temperate fruit crops such as pip and stone fruit, farmers/growers naturally expect the longer term loss to be indemnified.

Technically, when losses are severe, it is possible to make assessments. These could even include the costs of replanting and/or re-grafting. Paradoxically, the problem is greater when the damage to the wooded parts of the plants is less severe, but still sufficiently serious to mean a diminution in the following season's crop. In such cases the approach taken by Chile and Cyprus appear to be appropriate. An alternative may be to formulate wording such that fruit and trees are separate parts of the same policy.

(iii) Glasshouse Crops

Crops grown under glass, plastic or other coverings generally fall into the "high value input – high value output" category. As such, risk management planning is very important, since loss of the crop and/or the structures can mean a heavy financial blow. In fact in those countries where glasshouse and plastic house cultivation is important there insurance is usually an integral part of the production financial plan, and the potential liability for insurers is very substantial. Sometimes insurers offer policies which cover the structure together with the growing crop. Generally these also specify minimum standards for construction and the materials used in the structure.

(iv) Forests

The economic role of forests is undergoing a partial change. This change affects risk management and also insurance as part of risk management. The transition of national economies from a commodity to a service orientation also affects forestry. This is because a forest today is not just a source of timber for paper for building and furniture but also a provider of environmental services. Increasingly it is becoming possible for forest owners to generate income from the sale of carbon credits. This opens up forestry to a new and more commercially oriented class of investors. And this change will affect developing and developed countries similarly.

A further change is the move towards the certification of forests as environmentally sound entities, under some sort of recognized certification system. The implications for forest managers are twofold.

Firstly, such certification opens up access to markets which will only accept timber from forests certified as being sustainably managed.

Secondly, since it is based on the achievement of a high standard of management, including risk management it could lead to substantial reductions in insurance premiums owing to the involvement of such certification.

The major risks to forests are fire and windstorm. These perils will affect virtually all species of timber trees, although some are more at risk than others. For example, in recent years there have been extensive commercial plantings of various types of *Eucalyptus* species in many parts of the world. This tree type is popular because it is very fast growing and has considerable drought resistance. However, it also has a high content of oily volatile sap, meaning that it burns readily. When forests are insured against fire risk then considerable attention is given to management procedures to reduce the possibilities of loss in the event of a fire outbreak.

In summary, the worldwide changes to the forestry scene mean greater commercialization of tree cultivation, and therefore, greater opportunities for introducing insurance as a risk management device.

3.4.5 Analysis of Insurance Options – Loss Assessment Issues

Loss assessment is a key element of standard insurance. With crop and forestry insurance it is essential that loss assessment procedures can be designed for the crop and the perils involved. This is not always the case. A common problem is when a loss occurs which could have been caused by more than one peril. When the policy is not 'all-risks' but rather 'named-perils' then any loss assessment process should be able to ascertain as to whether the loss was caused by an insured peril. Unless this is possible then the crop/peril combination may be impossible to insure.

In any insurance contract it is vital that the process of loss assessment is made clear, so that in the event of a loss, the assessment process can start in a manner which has the prior agreement of both insurer and insured. The first element is to check that the loss falls within the scope of the policy. This is not always a straightforward issue, since some losses have more than one cause, and some of these might be covered by the policy, others not. The loss must then be measured, and the indemnity to be paid determined. The whole process of assessing the loss, determining the indemnity and paying it is known as *loss adjustment*.

Unlike other types of property insurance, when a loss can be assessed without the "biological factor", crops and trees have the capability of compensating for damage. Compensatory growth is a plant's response to damage. Some examples will illustrate how this can impact on insurance and on the assessment of losses. Hail can do devastating damage to grapevines. If the hail event is in the spring, fruiting parts can be knocked off.

However, the plant will normally grow new fruiting parts from existing buds, and a crop will result. The loss in this case is likely to be a reduction in the quantity and also in the quality of the fruit, but there will be something to harvest. On the other hand, late summer hail damages the grape bunches themselves and it can cause an almost complete loss of the season's production. It is too late for compensatory growth, so an insurer, working with the grower, will assess whether or not any salvage can be undertaken. Table grape market values are heavily hit by partial hail damage to the shoulders of the grape bunches. In such cases, even though the bulk of the fruit in the bunch may be undamaged, the prominence of hail damage on the shoulders of the bunch means that the grapes may not find a market. This may lead a loss assessor to declare a *constructive total loss*.

Compensatory growth is something that a crop loss assessor will take into account, drawing on the considerable research which has been done on the more important field crops, which gives an indication of the extent to which some of the loss is made up by natural processes.

3.4.6 Insurance Administration

The management of agricultural insurance has a number of stages. These are: market identification, product development, marketing, setting indemnity and premium levels, collecting premiums, handling claims. The over-riding aim in the design of administrative structures and procedures is to lay a foundation for minimizing the costs. Since the potential clients comprises small and often widely dispersed growers, costs can easily escalate to the point of non-viability of the business.

In this connection, the new and innovative insurance products offer much scope for drastically lowering the costs of administering a financial risk management mechanism. The various stages of standard insurance administration offer some scope for economies. The tasks involved in these stages are briefly described below.

(i) Market Identification

This is a vital stage. Buying of insurance involves increasing the up-front costs for a grower. The advantages of buying cover must be clear. Firstly, this means recognizing that insurance as such may not have a legitimate role in a particular industry for the major perils, as seen by the owners. Secondly, where there is believed to be a role, it means that careful attention must be paid to benefit/cost considerations for both contracting parties – the insured and the insurer.

These two conditions can best be met by identifying the real points of financial risk in an enterprise type and examining whether a financial risk-sharing mechanism can be economically applied. A formal, commercial market implies the ability to collect information on quantities of production from particular growers. Time series data of this type, since they are based on transactions involving payment, is likely to be highly accurate. A market outlet may also facilitate administrative economies in arranging the insurance cover or paying premiums.

The establishment of crop insurance as a new line of business whether for an existing company or a new entity can be benefited from the best experience available. At the time of writing the required expertise is most likely to be found within the reinsurance industry, and with specialized consultants/researchers. There is a role here for international agencies in making the necessary contacts, and assisting with the costs.

(ii) Product Development

Once the administrative business structure is in place, attention must be given to developing a product or line of products to meet the already identified demand. It is at the stage of product development that it is necessary to identify the point at which insurance could most economically impact on and substantially contribute to growers' risk management strategies.

Whereas each industry will have its own special features, problems and opportunities, one general point can be made. Product development is a highly skilled task, requiring both detailed knowledge of farming and/or forestry coupled with a sound appreciation of the principles and operational imperatives of insurance.

This can be an expensive stage of the process and international agencies can often assist in this regard. This assistance might be in the form of direct partnership in product design, or training existing insurance staff to handle the new challenges. In practice, it is likely to start with both approaches. What is important to note is that the design of insurance products, like the design of products for other financial services, is an ongoing task and to be carried on as continuous basis.

(iii) Marketing

Implicit in any moves to start crop insurance is based on the assumption that there is a demand for the product. Whereas automatic insurance has many advantages, as noted earlier, it is not always possible to design this type of policy. Marketing therefore is important. Several factors are important here²⁰:

- ✓ Close links with the representatives of farmers and foresters, and speedy response to new needs for insurance;
- ✓ Similar linkages with banks, farm product buyers and others are essential. There exists every possibility of insurance being rolled into a seasonal cropping loan. In this type of arrangement the marketing is automatic, at very low cost;
- ✓ Attention to appropriate publicity;
- ✓ Scrupulous fairness in loss assessment and claims handling;
- ✓ Speedy payment of claims is very important in any situation.

(iv) Setting Indemnity and Premium Levels

The basic issue to be addressed in traditional agricultural insurance is whether the insurance is meant to substitute for farm income in the event of a loss event or whether the indemnity would merely cover the cost of inputs lost because of crop damage. With index policies the choice would be more flexible, since an insured individual could choose the level of coverage, purchasing the number of units which suits his or her needs.

In any case, it is vital that an actuarial balance is struck between premium and indemnity levels and this balance be continually checked in order to ensure the financial sustainability of the programme, and its ability to meet commitments to insured growers.

A major area of difficulty in setting indemnity and premium levels is the lack of data linking the incidence of adverse weather events and actual losses in the field. Experience has shown that historic newspaper reports are unreliable (they usually exaggerate the losses) and that reports kept by government ministries are similarly inaccurate, since in the absence of insurance there is little incentive, or need, for precision.

In any case, insurance products in agriculture are seldom launched on the basis of all the data an actuary would wish to have in order to set premiums at the level required to meet expected indemnity liabilities. Experience must be gained during the early years of a programme. During this period adjustments can be made to the indemnity and premium levels, and also to the percentage of deductible applied.

(v) Collection of Premiums

The main objective here is to keep costs as low as possible, so there is a strong incentive to build linkages with existing providers of services to the farm and forestry sector.

Perhaps the most obvious linkage is between the insurer and banks serving the same clientele with the loan included as a component of the seasonal cropping expenses. Since the premiums in such cases are paid in bulk by the banks to the insurer, costs are minimized.

(vi) Handling Claims

Again, cost containment is very much an objective in designing procedures for the notification of claims, assessing the losses and paying indemnities. A further potent field for cost economies is through building linkages with entities already providing services to growers. These include banks, input suppliers, processors and other buyers. Sometimes, when loss assessment is done on an individual basis, the process can be made more efficient by the ready availability of detailed information with all details of the claim on which farming has been done – including data on the cropped area and full cropping history.

3.4.7 Roles of the Government and Private Sector

As a business insurance belongs in a business setting. On the other hand, the very nature of agricultural insurance means that there is bound to be strong governmental involvement. Most governments have a close interest in risk management in agriculture, both for productivity reasons, and concern for the wellbeing of rural populations. This often means that governments are active not only in an overall policy sense, but can be more intimately involved in various ways. These can range from initial investigation of the feasibility of introducing agricultural insurance products, leading to eventual promotion, and even financial participation.

At the same time, and as stated above, there are strong reasons for the business operations in insurance to be handled by a commercial concern, for reasons of efficiency and convenience in terms of insurance operations complementing other commercially-run services to farming.

This dual parentage of crop insurance can lead to tensions. The most crucial areas of concern lie in the areas of premium setting and claims handling. In these areas experience has shown that undue and inappropriate political influence on an insurer can be very damaging. In India the premium levels for the major state-run crop insurance programme were set by government, on political rather than actuarial grounds.

There are several roles of the Government to design sound crop insurance scheme following may be suggested as underlining principles.

- ✓ Ensure that any existing company or new entity has a sound legal basis on which to offer insurance products, with the required level of business competence.
- ✓ Clarify the government's objective in promoting crop insurance. Is it purely an additional risk management mechanism, or is it also an avenue of subsidy to the farming sector? If the latter is the case, then the avenue for financial support has to be ring-fenced from day-to-day political interference. This is not easily done, yet it is essential if there is to be the required continuity of financial conditions in order to build efficiency and fairness into the system.
- ✓ Establish strong linkages, at an early stage, with international re-insurers. These companies can assist not only with technical advice, but can also be instrumental in ensuring the necessary adherence to correct application of premium setting procedures, and settlement of claims.

3.5 PERILS IN AGRICULTURE

The foremost element of Risk Management in Agriculture is the management of key perils or threats in agricultural. In **Chapter 3.5** we have clustered different types of perils into four broad groups Namely, (a) Production, (b) Natural Resources, (c) Financial, (d) Marketing²¹.

Production and natural resource perils are especially pertinent to the present study of Risk Management in Agriculture, and are discussed in greater detail below.

Production Risk Perils is the main category of insurable risks. Both quantity and quality losses can result. Perils included are:

- ❖ Adverse climatic conditions: drought, excessive rain, flood, frost, hail;
- ❖ Pest and disease attack;
- ❖ Fire.

3.5.1 Drought

Drought is both a major concern of many developing countries. Insurers feel most confidence when an adverse event has a clearly defined time of impact, coupled with a clearly defined geographical area. The classic example is hail, which may do its damage in a matter of a few moments and will typically impact within a restricted area. By contrast drought has a vague beginning. Its effects linger for a very long time and can extend over more than one growing season. Moreover it typically impacts a very wide land area. Production loss caused by drought can be aggravated by the incidence of other problems, e.g. diseases attacking plants weakened by water stress.

From a purely underwriting point of view drought poses great difficulties for a standard crop insurer offering what is in effect a yield guarantee²².

Firstly, because drought affects a large number of growers in the same season – perhaps the whole of a country – the production losses are very large. This systemic or catastrophe exposure means there are problems in mobilizing sufficient insurance capacity to cover the sum at risk, even with recourse to substantial reinsurance.

Secondly, droughts in recent years, at least in many parts of India, have tended to extend over more than one year. This experience means that it is extremely hard for insurance companies to obtain reinsurance for crop insurance portfolios which carry drought risk.

Thirdly, the magnitude of the risk in most developing countries means that actuarially calculated premiums would be very high – too high perhaps to attract all but the most at-risk growers. No insurer wants to build a portfolio based entirely on such a clientele.

For these reasons insurers are very wary of covering drought as an inclusion in standard crop insurance policies. This is particularly the case in those parts of the developing world where drought is the major weather constraint to crop production. This also illustrates the key role which drought plays in the lives of much of the developing world's rural population.

Index insurance involves using a meteorological measurement as the trigger for indemnity payments. In the case of an index policy covering drought, the most likely form would be a series of indemnity steps, each step corresponding to a given level of rainfall deficit. The assumption is that growers could select a level of indemnity suited to individual circumstances. Thus the indemnity payable would increase as the deficit in rainfall increased from a defined "drought trigger" amount. At the time of writing, index policies covering drought or other climate risks cannot be described as being a standard product for developing countries. Rather they are in the nature of a promising new insurance technique, attracting much interest among risk management professionals.

3.5.2 Excessive Rain

Crops need water, and much of the developing world's arable and horticultural production relies on rainfall. Too much rain at any time can damage a crop, but there are some periods of special vulnerability which may be described below.

The first danger point is excessive rain just after germination and emergence. Entire crops can be washed out of the ground, necessitating re-sowing. This is an insurable risk, where the indemnity which would be written into the policy would be the costs of re-sowing, plus a possible additional amount in those cropping situations (common in tropical, rain-fed agriculture) where a delay in sowing means that the eventual harvested crop is smaller than would have been the case had the crop been able to take advantage of the whole of the normal growing season.

The next common point of vulnerability is at or near to harvest. Maize and other grains can sprout prematurely while still growing in the field. Various fruits (e.g. cherries) can be damaged by excessive rain or even any rain just prior to harvest. Other crops can be lost when excessive rain prevents harvest. An example is a crop such as tomatoes grown for processing.

3.5.3 Flood

Flood damage may occur due to on-site excessive rainfall. It can also be caused by excessive precipitation elsewhere and the subsequent rise of river and lake levels cause flooding of crop land. The risk is usually insurable. Exceptions would be crop land which is insufficiently drained or where existing drains are not maintained, and also flood plains exposed to a very high risk of flooding.

3.5.4 Frost

There are some regions where this is an occasional risk, especially to vegetable and fruit crops. This applies especially to Eastern Europe and the Middle East. Frost causes damage by the freezing of the water content of plant cells, and their subsequent rupture. Crop insurers write policies by constructing damage point (i.e. insurance trigger) curve which plots temperature against time.

An insurer may expect growers to take normal precautions against frost damage, through the use of devices to move the air (e.g., propellers mounted on towers, introduced in some of the fertile fruit growing valleys in Syria). All of these measures involve cost. Design of an insurance policy to respond to frost damage will take into account the inevitable trade-off between the costs of physical and financial measures of managing the risk. Usually the most cost-effective approach is a blend of the two, with insurance acting as a final safety net, to be triggered if the physical devices fail to prevent damage.

3.5.5 Hail

Hail holds a special place in the history and also the current practice of agricultural insurance. It was the first crop peril to be insured by a modern insurance company – the first policies being issued, in Germany, in 1791.

Hail is also the simplest of weather perils to handle from an insurance point of view. Its incidence is readily confirmed by observation of damage, and compensatory growth factors are reasonably well understood for most major insured crops. Moreover, over time, the likelihood of hail events in any given agricultural area can be estimated in a manner that permits actuaries to confidently set premium levels at values which both sides, insured and insurer, find reasonable. This is due also to its long history, and the manner by which records of damage have been prepared and retained over the years.

Again, when hail strikes it is usually very confined in terms of the damage zone. This can be just a few square meters, a few hundred square meters, or, more rarely a few square kilometers. It is seldom larger than this.

There is little that a grower can do against hail damage. Extensive research has proven that injecting hail clouds with silver iodide via rockets or planes is not very effective. Areas with very high hail exposure and expensive crops can resort to hail nets.

3.5.6 Pest and Disease Attack

Insurance cannot substitute for sound management of the risk of pests, parasites and diseases. Indeed, this is a significant area of modern farm and forest management as substantial losses resulted from failures in this area. Moreover the growing importance of international trade in agricultural commodities impacts on the pest and disease issue in developing country farming in several ways²³:

- Evidence of pest or disease in a consignment may disqualify produce from entry to the country of destination; similarly,
- Pesticide residues are subject to very tight limits under the standards for international trade;

Insurance implications can similarly be summarized in a brief list:

- ✓ It is sometimes possible for growers to obtain cover against pests and diseases where there is no generally accepted management control;
- ✓ Frequently damage to fruit and other crop products provides an entry point for disease organisms. Perforation of the skin due to hail damage is a common example. In this case any hail policy needs to be clear as to whether the consequential loss from disease is also covered.

3.5.7 Fire

Fire is one of the oldest perils to be covered in property insurance. Fire is a major peril for many crops (especially broad field crops such as grains) and for virtually all forests. It is commonly included in multi-peril crop insurance, and is frequently the key peril under forestry covers (which may also include wind and snow damage). Fires are caused by human action (and carelessness) and also by lightning strikes during electrical storms. Whatever the cause, there are control measures to reduce any losses. These may be through early detection and the subsequent means to take action and/or through the use of cleared firebreaks. Insurance policies will normally state the expectations under the policy of the means to control fire losses. Again this is an example of insurance being just a part of a cluster of measures used to control risk.

3.5.8 Natural Resource Risks

These include:

- ✓ Adverse soil conditions, e.g. salinity, erosion of topsoil and loss of soil nutrients;
- ✓ Deterioration in water quality e.g. due to pollution of the water table;
- ✓ Lack of supply of water from the irrigation source.

Mainly these risks are best addressed by farm management practices. However, some of the underlying causes of these problems may themselves be insurable. For example, soil erosion may follow excessive rainfall and/or wind. Pollution of water may be beyond the control of the farmer drawing from wells or rivers. Related to this is the risk that a water source used for irrigation may fail. Prolonged drought means that water tables fall, necessitating the boring of deeper wells. Similarly rivers and streams can dry up, due again to drought, or to an increase in uptake of water upstream. Where this involves another country then this falls into the political risk zone, something that many insurance policies specifically exclude.

3.6 CROP INSURANCE PRODUCTS

3.6.1 Classifications Agricultural Insurance

Agricultural insurance has various facets. Depending on the kind of farming activity, the kind of animals and crops, and the kind of perils they are exposed different agricultural insurance covers are applicable. Traditionally agricultural insurance can be categorized as **Animal Insurance** and **Crop Insurance**²⁴.

Animal Insurance

The application of animal insurance in the world especially in the developing countries is very insignificant. There exist two types of animal insurances: These are ***Livestock insurance*** and ***Aquaculture Insurance***

Livestock insurance usually covers losses resulting from death, diseases and accidental injuries. As single animal policies are very expensive to administer, herd insurance is the most common livestock insurance cover in some of the developing countries. In some cases, diseases are covered through governmental programmes.

Aquaculture comprises the breeding and growing of aquatic animals in inland ponds or coastal waters. It usually covers losses resulting from death or loss of fish stock due to meteorological events, diseases, pollution, algae blooms etc.

Due to the non-availability of consistent information, animal insurance has been kept outside the periphery or scope of the current research work. The concepts of different crop insurance products are discussed below.

Crop Insurance

Crop insurance may be of different types according to different criteria. The types as per criteria used could

1. Classic or Traditional Crop Insurance Products
2. New Crop Insurance Products

The different types of crop insurance products are enumerated in details.

3.6.2 Classic or Traditional Crop Insurance Products

These crop insurance products account for by far the bulk of all crop insurance written globally. There are two main types, damage-based and yield-based products respectively. These are introduced below.

(i) Damage-based Products (e.g., Hail/Named-peril):

Insurance against crop losses from hail has been insured for many years. This type of crop insurance still accounts for a considerable proportion of crop insurance worldwide. The policies are based on a measure of the actual damage. The key features are as under.

1. Damage resulting from the peril is localized;
2. Low degree of correlation of risk over a given area;
3. Sum insured is agreed when the policy is purchased;
4. loss adjustment and eventual indemnity based on measurement of the percentage of damage after the incidence of the loss event;
5. This type of insurance is not suitable for perils which can impact over wide areas, e.g., drought, pest, disease.

(ii) Yield-based Products

Actual Production History (APH) (often simply called “multi-peril crop insurance” [MPCI]) provides protection against a loss in yield due to natural causes. For most crops, this includes drought, excess moisture, cold and frost, wind and flood. The insurance guarantees a yield based on the actual production history. If actual production is less than the yield guarantee, the insured will be paid indemnity.

Multi-peril crop insurance (MPCI) products have the defining characteristic that insurance is geared to a level of expected yield, rather than to the damage that is measured after a defined loss event. Other features are²⁵:

1. MPCI policies are suited to perils the nature of which means that their individual contribution to a crop loss is difficult to measure;
2. Similarly these yield-based policies are suited to perils which impact over a period of time;
3. Establishing a farmer’s yield history provides the basis for determining the percentage of shortfall after a loss event;
4. Yield shortfall may be determined on either an area or individual farmer basis.

3.6.3 Problems of Traditional Agricultural Insurance Products

The reasons for the difficulties in modeling agricultural insurance schemes for low income households are manifold. Crop Insurance thus not only affected by common problems of insurance but also by problems very specific to the agriculture sector.

(i) Common Problems in Insurance

Like many other forms of insurance, traditional agricultural insurance suffers from problems arising from asymmetric information, which means that insurers have different (mostly less) knowledge about the risks. The asymmetry of information causes adverse selection and moral hazard problems²⁶.

Adverse selection

Adverse selection in insurance markets means that only high-risk customers of the intended target group purchase the insurance cover. This leads to a higher loss ratio of the actual risk portfolio in comparison with the expected risk portfolio on which the premium rate was calculated.

Adverse selection also refers to the situation in which insurers find it impossible or very expensive to distinguish between high-risk and low-risk insurance applicants. Over time, the low-risk clients drop out of the market. The insurance company is left with a pool of very high risk clients with higher than expected indemnities, which negatively affects the insurer's profitability.

Moral hazard

Moral hazard refers to the situation where the granting of an insurance contract can lead clients to reduce their use of good husbandry practices or completely alter their production practices, resulting in higher loss claims. For example, assured compensation for flood or hurricane damage to homes can lead to the building of more houses in flood and hurricane prone areas than prudent investors would otherwise build. Similarly, assured compensation for crop losses in drought-prone areas may encourage farmers to grow more of the compensated crops even if they are more vulnerable to drought than alternative crops or land uses.

These two problems affect all insurance markets, but are worse in the agriculture sector, where obtaining information on a client's risk exposure and assessing individual losses is much more difficult. Also the monitoring of client behaviour to minimise moral hazard problems is more time-consuming and costly in this sector.

Education/communication

In most of the developing countries the introduction of crop insurance is a great challenge as it is very hard to gain trust and understanding for insurance schemes. And it is difficult to explain that premium payments are not savings leading to repayments if the insurance cover was not needed during the year. The need for awareness-raising and trust-building campaigns leads to higher distribution costs for insurance companies.

(ii) Specific problems of agricultural insurance

Correlated risk

In agricultural insurance, an important rule for insurability tends not to hold: risks are not completely independent and spatially uncorrelated, as weather events tend to affect a large number of farms over a widespread region. Normally, such correlated risk cannot be pooled. Especially small rural financial institutions are simply not capable of insuring risks affecting most of their customers at the same time. The diversification of the risk portfolio is therefore essential for the financial viability of the insurance companies – which in turn means that they need the possibility to transfer part of the risk to reinsurance providers or international financial markets.

High administration cost

A major constraint of agricultural insurance is the high administration cost. While benefits under life insurance, for example, become due with the death of the insured (proven by the death certificate), crop insurance usually requires the assessment of the degree of damage to the insured crops by an expert, with all the cost associated with the time for travelling and dealing with the claims procedure. Additionally, the danger of fraud is higher, as the insured event can be induced by the insured.

Non-transparent and unequal free disaster assistance

Agricultural insurance also faces the problem that households are not willing to pay for insurance if they can expect government compensation for natural disasters heavily affecting their crops. While free disaster aid is not a problem for itself but often the non-transparent and unequal nature sets wrong incentives.

In some cases, governmental disaster assistance has also been granted for political reasons rather than in response to actual losses sustained by farmers in a specific region. Disaster assistance rules must be made explicit and compensation must be accessible to every farmer. If only those farmers are compensated who decided not to buy insurance cover, the risk-sensitive farmers who have bought the insurance cover will be punished for their prudence.

Lack of infrastructure (information and distribution)

In order to calculate and value risks properly, insurance companies need good historical data going back at least ten (preferably 20 and ideally 30) consecutive years or more. This means that designing agricultural insurance products is very challenging, as most developing countries lack meteorological data for the last few decades due to the deficiency in infrastructure to measure it. Secondly, in rural areas the lack of infrastructure affects sales possibilities in the target regions for agricultural insurances. Thirdly, the functionality of insurances products is still new to small farmers in developing countries, which makes time-consuming and customer education is necessary.

3.6.4 New Crop Insurance Products

Owing to the dynamism of research and development into new methods of managing risk through insurance mechanisms two fairly new group of insurance products have been emerged in the crop insurance sector. These are as under²⁷.

- (i) Products based on insuring a level of crop revenue, and
- (ii) Products where insurable damage is determined in the basis of an index derived from data external to the insured farm itself.

(i) Crop-Revenue Insurance Products

The essence of this product is to combine production and price risk. The combination of production and price are the determinants of gross revenue from a given crop. Under normal supply/demand conditions a production shortfall might be expected to result in a rise in price. To some extent such a rise will cancel out the financial loss for the grower who suffers a production shortfall. But this will only be the case if the grower or farmer harvests sufficient crop and sells it at sufficient premium over the expected price. Crop-revenue insurance is designed to meet any remaining shortfall in revenue from crop sales. Frequently, too, crop-revenue products involve the determination of loss on an area basis, introducing important economies in the loss assessment process.

(ii) Index-based Insurance Products

In a classic crop insurance policy, evidence of damage to the actual crop on the farm, or in the area of the farm, is needed before an indemnity is paid. But verifying that such damage has occurred is expensive, and making an accurate measurement of the loss on each individual insured farm is even more costly.

An index (also known as 'coupon') policy operates differently. With an index policy a meteorological measurement is used as the trigger for indemnity payments. These damaging weather events might be:

- ❖ A certain minimum temperature for a minimum period of time
- ❖ A certain amount of rainfall in a certain time period;
- ❖ Attainment of certain wind speed (for hurricane insurance)

The classic insurance policy is replaced with a simple coupon. The coupon merely gives a monetary sum which becomes payable on certification that the named weather event, of specified severity, has occurred. The face value of the coupon may be standard, to be triggered once the weather event has taken place for the area covered. Alternatively it could be graduated, with the value of the coupon then being proportional to the severity of the event.

Index-based insurances pay for losses based on an independent and objective measure that is highly correlated with the losses. The insurance becomes due if a certain value of the predefined trigger is met or passed within a specific period of time, e.g. temperature, rainfall, etc. There is no individual claims settlement, but all people or associations insured are paid from the insurance once the threshold is passed. Prerequisites for an index-based insurance are stated below²⁸.

Pre-requisites for index-based insurances:

- ❖ Index must be a good proxy for the loss (high correlation).
- ❖ Event must be observable and easily measurable,
- ❖ Historical data and good infrastructure must be available.
- ❖ Measurement must involve a third party to prevent fraud.

Index insurance products offer an apparently practical solution to many of the barriers to classic crop insurance for small-scale, dispersed farmers in less developed areas of the world. Unlike in traditional agricultural insurance products, asymmetric information problems play a much smaller role in index-based insurance schemes. The index value cannot be influenced by individual farmers. Thus, less asymmetric information leads to less adverse selection and reduced moral hazard problems.

3.6.5 Advantages of Index-based Insurance Products²⁹

a) Less adverse selection

As indemnification is not based on individual losses, the insurance provider can calculate the risk more easily and more accurately, without depending on the information provided by the insured. Instead, indemnities are based on widely available information and there are few informational asymmetries to be exploited by the insured.

b) Reduced moral hazard

Management decisions are not affected by the index contract, as indemnities are not based on the extent of individual losses. Thus, farmers with index based insurance possess the same economic incentives to produce a profitable crop as uninsured farmers.

c) Reduced administration cost

Index-based insurance policies can reduce administration cost tremendously: not only do expensive on-farm inspections to assess the individual risk exposure and costly individual loss assessments become redundant, but the standardisation of contracts and easier claims settlement also make index based insurance schemes much more cost-efficient.

d) Standardised and transparent structure

Index-based insurance contracts can be uniformly structured, which not only reduces insurance costs but also increases the number of potential distribution channels.

e) Availability and negotiability

Being standardised and transparent, the contracts can be traded in secondary markets by the insurance companies, which facilitate risk transfer and portfolio diversification.

f) Flexibility and adaptation

In contrast to traditional agricultural insurance products, which cannot usually be tailored to the individual needs of farmers in a certain region, index-based insurances allow insurers to provide tailor-made solutions without extensive work on the product design.

g) Reinsurance function

Index-based insurance can be used to transfer the risk of widespread correlated agricultural production losses more easily to the international reinsurance market. Microfinance institutions can use index-based insurance as a means of hedging their loan portfolio³⁰. An important factor is the right quotation. International Reinsurers cooperate closely in the development process of such products.

3.6.6 Disadvantages of Index Based Insurance³¹

a) Basis risk

One of the major disadvantages of index-based insurance solutions is the portion of risk that is not correlated with the measured index, called "basis risk". As indemnification is not based on actual losses, but triggered by the index, there is a potential mismatch between the insurance payout and the actual losses of the farmer. If a regional weather event does not trigger the cover, an insured farmer will get no compensation even though he is heavily affected by this event (basis risk).

b) Simplicity versus reduction of basis risk

When designing an index-based insurance scheme, insurance companies have to choose between a simple trigger structure (leading to lower design and administration cost) and reducing the amount of basis risk to be borne by the insured farmer. The more triggers defined in the scheme, the more complicated and costly the insurance policies are for farmers, who at the same time benefit from a reduced basis risk. The design of index-based insurance schemes is therefore crucial, requiring careful consideration and several consecutive pilot tests.

c) Forecasts

If index-based insurance contracts can be bought at any time throughout the year, forecasts can cause a situation of short-term asymmetric information about the likelihood of an event. This creates potential for inter-temporal adverse selection. Insurers usually avoid this problem by only offering the policies up to a certain date, before weather forecasts for the critical crop period can be taken into account for the purchase decision.

d) Micro Conditions

Frequent, localized events which would often trigger payouts make the application of index-based contracts difficult. Microclimates do not play a critical role in index-based insurance schemes, as they rarely exist and are usually incorporated in the index. Other micro conditions such as different compositions of the soil, an uneven terrain of the field may also lead to different crop yields.

3.6.7 Comparative Study on Crop Insurance Products

On the basis of the above hypothetical discussions, a comparative study on strengths, weaknesses, opportunities and threats of different categories of crop insurance products may provide a clear perception on the subject matter. The findings of the study have been demonstrated in the **Figure 3.3**

Figure: 3.3

Comparative Study on Crop Insurance Products

Type of Product	Type of Coverage	Strengths	Weaknesses	Opportunities	Threats
Single-Peril	Hail Fire High Winds	Easy to observe and verify claim adjustments	Subject to Moral Hazard Problems	Ease to determine actuarially sound premium (as long as long historical series of weather and loss data exists.)	Farmers may not take appropriate precautions against fire and wind damage.
Multiple Peril	Covers most all natural hazards	Attractive to farmers	Actuarially Unsound— essentially covering highly spatially correlated and uninsurable risks Subject to Adverse Selection and Moral Hazard Costly to Administer	Premium Subsidy is Provided by the Govt. or Implementing Agencies	In the case of plant disease and pest damage, hard to disentangle management failures from external factors. Ends up being an income transfer scheme disguised as risk management tool

Type of Product	Type of Coverage	Strengths	Weaknesses	Opportunities	Threats
Revenue	Combines multiple peril yield protection with a price variability component.	Very attractive to farmers.	Actuarially unsound. All of the above multiple peril weaknesses apply.	If crop prices at harvest time fall below a guarantee level based on futures prices a payment is made.	Basically an income transfer program.
Parametric or Index Based	Covers yield losses due to an easily observable random variable that is highly correlated with particular crop yield	Not susceptible to adverse selection Less susceptible to moral hazard Low monitoring costs Affordable premiums	Suffers from basis risk Not appropriate in hilly, mountainous areas where a variety of microclimates exist, or where farmers are very risk adverse.	Well suited for low-income, limited resources farmers in drought prone areas. Very flexible instrument, can be targeted to intermediaries and government disaster funds	Very dependent on quality and quantity information available for developing risk models of probable loss.

3.7 REINSURANCE IN AGRICULTURE

3.7.1 Concept of Reinsurance³²

Reinsurance is insurance for insurers. When the total exposure of a risk or group of risks presents a hazard beyond the limit which is prudent for an insurance company to hold, the insurance company may purchase reinsurance. As a consequence, the insurance companies transfer part of un-diversifiable or extreme risk in their portfolio to reinsurance companies. This purchase is also known as 'ceding'. Just like insurance, reinsurer pays a premium for taking on a portion of the risk from insurers. Reinsurance has many advantages. These are as under.

- (i) It Levels out the results of the insurance company over a period of time;
- (ii) Limits the exposure of individual risks;
- (iii) Reinsurance may increase an insurance company's solvency margin (percent of capital and reserves to net premium income) as well as financial strength; and
- (iv) The final result is a stable loss ratio for the insurer over the period of insurance.

Reinsurers seek to operate across boundaries in order to build globally diversified portfolios.

3.7.2 Types of Reinsurance Contract³³

Traditionally reinsurance agreements can be "proportional" or "non-proportional." With "proportional" agreements insurers and re-insurers divide premiums and losses in a contractually defined proportion, while with "non-proportional" agreements the insurer usually pays all losses up to a defined amount and the reinsurer indemnifies for losses above that limit. "Quota-share" and "surplus" reinsurances are examples of proportional reinsurance agreements. "Excess of loss" and "stop loss" reinsurances are examples of non-proportional reinsurance agreements.

(i) Proportional Reinsurance Contract

Under a **Quota Share** treaty the reinsurer shares proportionally in all losses and receives the same proportion of all premiums as the insurer, less commission. Proportional reinsurance is often recommended in the start up phase of new programs when an insurer has little experience with that class of business, and often limited to capital or reserves for the purposes of retaining risk. The drawback is by ceding a high proportion of the premium to re-insurers, the company does not build either its reserves or the profits for its shareholders.

Another form of Proportional Treaty is a **Surplus Reinsurance Treaty** where the reinsurer is bound to accept the surplus liability over the insurance company's retention of the risk. Insurance company generally uses surplus treaties to underwrite much larger risks.

(ii) Non Proportional Reinsurance Contract

In the case of Non Proportional Treaty Reinsurance the reinsurer agrees to pay all losses which exceed a specified limit arising from an insured portfolio. The limit is usually set by the reinsurer and may be monetary e.g. Excess of loss or a percentage e.g. Stop loss. The **Stop Loss** reinsurance rates charged by the reinsurer are calculated independently of the original gross premium rates for the insurance charged to the insured. Stop Loss Treaties are appropriate to situations where the insurer has accumulated experience over time, it has accumulated reserves and developed a stable portfolio and it is actively seeking to retain and expand its original premium and profits.

3.7.3 Alternative Risk Transfer and Reinsurance Market

Securitization is an alternative to traditional reinsurance through which catastrophic risks are transferred to capital markets in the form of financial securities. The alternative risk transfer market (ART) is composed of two segments – risk transfer through alternative risk carriers such as captives and the capital markets, and risk transfer to re-insurers through alternative products.

The capital markets have entered into the reinsurance business through the provision of alternative risk transfer and financing instruments. To date these products have by and large been underwritten in developed economies for catastrophe exposures such as earthquake, flood, hurricane or terrorism. Pollner et al (2001) identified the following main instruments available through private capital markets in the US, Europe and Japan³⁴:

- Catastrophe Bonds;
- Contingent Surplus Notes;
- Exchange Traded Catastrophe Options;
- Catastrophe Equity Puts;
- Catastrophe Swaps;

Finite risk reinsurance is an alternative risk transfer product. ART products can be customized to meet a client's specific need and can include a large finance component. Finite risk reinsurance represents a shift in the risk management spectrum from traditional risk transfer towards risk financing. Finite risk covers are multi-year contracts which, by taking into account individual loss experience and investment returns, reduce the client's cost of risk management. However, while the year-to-year volatility in loss payments is reduced, the total amount of risk transfer over the contract period is limited.

3.7.4 Agricultural Reinsurance Market

Guy Carpenter (An international Agricultural Risk Management Agency) estimates global agricultural reinsurance premiums about US\$ 1.3 billion in 2005. Slightly over 57% of this agricultural reinsurance business originates for North America (USA and Canada) and the remaining 43% is worldwide³⁵.

Table 3.1 lists the leading specialist agricultural re-insurers with the best estimates of their market share of agricultural reinsurance premium. SwissRe and MunichRe are the largest agricultural reinsurers respectively with about 25% and 20% market share. In 2005 SwissRe acquired GE Frankona and from June 2006 the companies have commenced underwriting as a single entity. In recent years various Bermudan reinsurers have entered the crop reinsurance market.

Table: 3.1
List of Leading Agricultural Reinsurers in 2005

Company	% Market Share
SwissRe (+former GE Frankona portfolio)	25%
MunichRe	20%
PartnerRe	7%
HanoverRe	7%
Bermudan Reinsurers (e.g. Axis Specialty)	7%
EnduranceRe	7%
Lloyds of London (e.g. Limit, Syndicate 566)	7%
Convarium	5%
SCOR	5%
Other (e.g. ParisRe)	±10%

Source: www.guycarp.com

In comparison with other life and non-life reinsurance markets, the growth in agricultural reinsurance market is very insignificant. Presently the World Bank has taken special initiatives to strengthen the position of international agricultural reinsurance market.

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