3 INDIAN AGRICULTURE, MAJOR RISKS AND ITS MANAGEMENT

3.1 CHARACTERISTICS OF INDIAN AGRICULTURE

At the time of independence, the agricultural economy of the country was characterized by a stagnant economy with wide regional diversities, lower resource availability, inadequate institutional support and acute poverty. The period prior to independence was marked by the retrogression of agriculture sector and ended by leaving the country with perhaps the world's most refractory land problem (Thorner and Thorner 1958). Land reforms were taken up as an immediate measure to correct the skewed distribution of land and inadequacies in the land market. Land reforms were directed towards favouring the peasant cultivator through tenancy reforms, abolition of intermediaries and bringing equity in access to land and other resources. Laws of inheritance and land fragmentation led to marginalization of agriculture.

Indian agriculture is characterized by small holdings and farmers operating less than one hectare of land accounted for
roughly 60 per cent of the more than 106 million farming families in 1990-91, operating just 15 per cent of the total area. In addition to this, another 20 million families operate between 1 to 2 hectares of land and they share roughly one fifth of the total holdings (GOI 2001).

The Community Development (CD) Programme initiated in 1952 for the development of villages by co-ordination of the activities related to agriculture, animal husbandry, infrastructure and extension at block level helped creating rural infrastructure across blocks. National Extension Service programme was also initiated along with the CD programme. The emphasis from the sixties onwards was to increase agricultural production. This had a twin goal: first, to make India self-sufficient in food grain so that its food security was assured and second, to ensure that farming activity brought prosperity to the farmers and raised those above the level of subsistence to which most of them were accustomed.

The sixties witnessed two important interventions in agricultural development. One was in the form of Intensive Agricultural District Programme (IADP) of 1960-61 for selected districts in the country and the other, as Intensive Agricultural Area Programme (IAAP) of 1964-65. In the following years, we
witnessed the advent of green revolution. The high yielding variety seeds, fertilizer and irrigation technology helped boost food grain production in the country in the following years. The impact of technological change was felt throughout the country but more vigorously in a few states and for a few crops. Commercialization of agriculture is not a new phenomenon. Crops like cotton, sugarcane, jute and tobacco are being grown since time immemorial. However, commercialization accelerated during the last two decades. The area under food grain crops is being substituted by non-food grains / cash crops.

Subsistence farming where the farming family essentially tilled the land to produce something for its own consumption was from a business standpoint, a low risk activity. The system was characterized by lower dependence on purchased inputs (like seed, fertilizer, plant protection chemicals and even labour). However, this may not be so any longer and even small and marginal farmers are responding to market signals. The proportionate area allocated for food grain crops is being replaced by cash crops and this has very great implication for crop insurance. Farmers try to maximize the expected net income and at the same time try to minimize their dependence
on market for staple food. Thus, they choose a mix of staple food crops and cash crops. Staple food crops (mainly cereals) also provide fodder for livestock, which is an indispensable asset with the poor.

3.2 PRINCIPAL RISKS AND MANAGEMENT STRATEGIES OF FARMERS

Agricultural phases are exposed to controllable and uncontrollable risks. Controllable risks are pests, diseases, weeds, seed and faulty fertilizers or pesticides. Uncontrollable risks are deficit or excess rainfall, distribution of rainfall, extreme temperature conditions, hail storms, wind speeds, humidity and fog etc. Technology, effective monitoring and usage of inputs mitigate controllable risk. The challenge is risk mitigation for uncontrollable risks.

3.2.1 RISKS IN AGRICULTURE

In a world of rising population, diminishing arable land, mounting agricultural debts and increasing uncertainties in farm incomes, there is a great need for management of risks in the agriculture sector. The enterprise of agriculture is subject to
great many uncertainties. Yet more people in India earn their livelihood from this sector than from all other sectors put together. In rural India, households that depend on income from agriculture (either self-employed or as agricultural labour) accounted for nearly 70% of population (estimates from Survey of Consumption Expenditures, National Sample Survey, 1999/00). This includes large number of the poor who have little means of coping with adversities. Poor households that were self-employed in agriculture account for 28% of all rural poverty while poor households that are primarily dependent on agricultural labour account for 47% of all rural poverty\(^1\). Thus, 75% of all rural poor are in households that are dependent on agriculture, in one way or the other. The same survey shows that 77% of all poverty is rural. Thus 58% of all poor are in households that are dependent on agricultural income in rural areas. Risk and uncertainty are inescapable factors in agriculture. The uncertainties of weather, yields, prices, government policies, global markets, and other factors can cause wide swings in agricultural income. All these risks must be properly managed to achieve satisfactory management in

\(^{1}\) Estimates based on the Planning Commission poverty lines for urban and rural sectors of different states.
agriculture. It involves choosing among alternatives that reduce the financial effects of such uncertainties. Figure 3.1 shows various risks in agriculture.

Figure 1: RISKS IN AGRICULTURE

FARM HOUSEHOLD RISK

AGRICULTURAL RISK

NON-AGRICULTURAL RISK

PRODUCTION RISK
PRICE RISK
INPUT

3.2.2 TYPES OF RISKS

Management of risk in agriculture is one of the major concerns of the decision makers and policy planners, as risk in farm output is considered as the primary cause for low level of farm level investments and agrarian distress. Both, in turn, have implications for output growth. In order to develop mechanisms and strategies to mitigate risk in agriculture it is imperative to know the sources and magnitude of fluctuations involved in agricultural output.
Farmers are exposed to risk from rainfall variability, market price fluctuations, credit uncertainty and adoption of new technology. The diversities in the sources of risks require a variety of instruments for protecting the farmers. In India, these include crop insurance, rainfall insurance, farm income insurance and a calamity relief fund. Most of these measures other than crop insurance are in the experimental stage. Different sources of risk that affect agriculture are classified below.

- Production Risk
- Price or Market Risk
- Financial and Credit Risk
- Institutional Risk
- Human or Personal Risk
- Legal / Policy Risk
- Resource Risk
- Health Risks
- Assets Risks
- Technology Risk
3.2.2.1 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 or threshing that may result in production losses. Development and adoption of innovations also add to production risk in agriculture.

In India, more than 60 percent of land is vulnerable to droughts. Droughts lead to economic losses resulting from low agricultural production, loss of animal wealth, reduced nutrition and loss of health of workers.

3.2.2.2 PRICE OR MARKET RISK

Price or market risk refers to uncertainty about the prices producers will receive for commodities or the prices they must pay for inputs. The nature of price risk varies significantly from commodity to commodity.
The market risks result from fluctuations in the prices of inputs and outputs, outside competition, changing supply and demand, market imperfections, changing consumer preferences, etc. Sale of farm produce under distress may take place due to lack of post harvest processing and lack of infrastructure storage facilities.

3.2.2.3 FINANCIAL AND CREDIT RISK

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. This also creates an obligation to repay debt. Rising interest rates, the prospect of loans being called by lenders, and restricted credit availability to the farmers lead to financial risks.

3.2.2.4 INSTITUTIONAL RISK

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.

3.2.2.5 HUMAN OR PERSONAL RISK

This risk refers to factors such as problems with human health or personal relationships that can affect the agriculture.

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.

3.2.2.6 LEGAL / POLICY RISK

The legal and policy risk arises due to changes in the government policies related to agriculture, failure to comply with contractual obligations, etc.

3.2.2.7 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 sometimes leading to suicides by the farmers.

3.2.2.8 HEALTH RISKS

The health risk arises due to sickness or injury to the farmer, low labour productivity due to poor labour management, family disputes, accidental death, etc.

3.2.2.9 ASSETS RISKS

The trade-off is most acute for small farmers because their opportunities for ex-post management of risk through credit are limited. When all other measures fail, farmers have no option but to sell their assets (principally livestock) or to migrate out to regions with better work opportunities.

3.2.2.10 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 in introduction
of genetically modified crops causes an increase in producer liability risk.

3.3 RISK MITIGATING STRATEGIES

In order to cope with various risks, farmers and rural societies have developed number of risk management strategies. These can be grouped as risk-reducing and risk-coping strategies (Walker and Jodha 1986). The ex-ante measures adopted to lower or minimize risks can be grouped as risk-reducing strategies whereas ex-post measures adopted to mitigate risks are classified as risk-coping measures or strategies. Table 6 summarizes these classifications.
Table 1: RISK MANAGEMENT STRATEGIES IN AGRICULTURE

<table>
<thead>
<tr>
<th>Ex-ante Strategies</th>
<th>Informal Mechanisms</th>
<th>Formal Mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-farm</td>
<td>- Avoiding exposure to risk</td>
<td>- Agricul-tural extension</td>
</tr>
<tr>
<td></td>
<td>- Crop diversification and inter-cropping</td>
<td>- Supply of quality seeds, inputs etc.</td>
</tr>
<tr>
<td></td>
<td>- Plot diversification</td>
<td>- Pest management systems</td>
</tr>
<tr>
<td></td>
<td>- Mixed farming</td>
<td>- Infra-structures (roads, dams, irrigation systems)</td>
</tr>
<tr>
<td></td>
<td>- Diversification of income source</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Buffer stock accumulation of crops or liquid assets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Adoption of advanced cropping techniques</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(fertilization, irrigation, resistant varieties)</td>
<td></td>
</tr>
<tr>
<td>Sharing Risks With Others</td>
<td>- Crop sharing</td>
<td>- Contract marketing</td>
</tr>
<tr>
<td></td>
<td>- Sharing of agricultural equipment, irrigation sources, etc.</td>
<td>- Futures contract</td>
</tr>
<tr>
<td></td>
<td>- Informal risk pool</td>
<td>- Insurance</td>
</tr>
</tbody>
</table>


### Ex-Post Strategies

<table>
<thead>
<tr>
<th>Informal Mechanisms</th>
<th>Formal Mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coping With Shocks</strong></td>
<td><strong>Market Based</strong></td>
</tr>
<tr>
<td>- Reduced consumption patterns</td>
<td>- Credit</td>
</tr>
<tr>
<td>- Deferred / low key social and family functions</td>
<td></td>
</tr>
<tr>
<td>- Sale of assets</td>
<td></td>
</tr>
<tr>
<td>- Migration</td>
<td></td>
</tr>
<tr>
<td>- Reallocation of labour</td>
<td></td>
</tr>
<tr>
<td>- Mutual aid</td>
<td></td>
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</tbody>
</table>

### 3.3.1 RISK-REDUCING STRATEGIES (*ex-ante*)

Risk-reducing strategies adopted by farmers include crop diversification, inter-cropping / mix cropping, or cultivation of drought or flood resistant crops. Diversification of activities, engaging in nonfarm/ off-farm activities, getting into contractual arrangements such as share cropping, labour hiring, etc. also form a part of *ex-ante* risk mitigating strategies.
3.3.1.1 CROP DIVERSIFICATION

Crop diversification is the most common and effective risk management strategy that is employed by the farmers. The farmer spreads risk across multiple crops and even if one crop fails, it is compensated by another crop. However, crop diversification leads to spreading of limited resources across crops and the price paid for diversification is income foregone or sacrificed by not growing the most remunerative crop. The same argument holds true in the case of intercropping also.

3.3.1.2 INTERCROPPING

Intercropping lowers yield risks because of lower incidence of insect/pest damage as well as disease. Intercropping has greater potential for yield compensation. It also provides opportunity to grow short duration crops along with long duration crops thus minimizing competition for soil nutrients and maximising the use of soil moisture, sunlight, etc. Even though intercropping is not found effective in reducing production risk as shown by positive covariance between the yields of inter crops (Walker and Jodha 1986), it certainly helps in avoiding complete crop failure (Singh and Walker 1984).
3.3.1.3 TENANCY OR SHARE-CROPPING

Tenancy or share-cropping helps to minimize risk in production. Share cropping is more beneficial particularly when the tenant is a small farmer and averse to risk, as the tenant has to share a fraction of output to the land owner and he is insulated against the fluctuations in output. On the contrary, ease or fixed tenancy shifts the entire risk of production to the tenant farmer. The risk-reducing strategy stabilizes farm income but at the same time the farmer has to forego income from other alternative activity, which would have fetched higher income. Similarly, diversification is usually less profitable on average than crop specialization (Hazell 1992).

3.3.2 RISK-COPING STRATEGIES

Farm families adopt different strategies to adjust the shortfall in income. The ex-post measures taken to mitigate the impact of income losses include self insurance, sale of assets, stored produce, and receipt of transfers from relatives, borrowals for consumption, increase labour participation and even migration for better employment opportunities.
3.3.2.1 SELF INSURANCE

This is the most important mechanism for consumption smoothing other than market credit and interfamily lending, sale and purchase of assets. Agricultural households hold many different forms of wealth including land, capital goods such as pump sets and tractors, animals, jewellery, currency and stocks of food grains. Self insurance relates to using such assets as buffer stocks. Farmers accumulate stocks in period of relative affluence and deplete these reserves to finance consumption expenditures during tough times.

3.3.2.2 CREDIT

The second major form of smoothing consumption is taking loans from formal and informal sources. Farmers approach formal or institutional lenders like Government banks, co-operative societies, commercial banks, credit bureaus as well as informal lenders like money lenders, traders, friends and relatives for taking credit.
3.3.2.3 TENANCY CONTRACT

The third strategy for mitigating risk is tenancy contract. Share cropping is the most popular form of tenancy contract. If the farmer is small and averse to risk, if a given fraction of output is paid as rent, then the farmer to some extent insulated against output fluctuations as he can share some of these fluctuations with his landlord.

3.3.2.4 LABOUR MARKETS

Labour markets provide alternative mechanism to deal with risk by allowing households subject to idiosyncratic income shocks to shift from own-farm cultivation to the labour market and to avoid uncertainties of the slack season/many landless workers enter permanent labour contracts to avoid seasonal fluctuations in wages and employment opportunities.
3.4 ISSUES AND NEED FOR INSURANCE

Production process in agriculture is entirely different than in other enterprises. It has been observed that the variability and instability in food grains production has increased in the post-green revolution period when compared to pre-green revolution period (Hazell 1982; Ray 1983, Rao et al, 1988). The crop output, particularly food grains, is sensitive to variations in rainfall.

Secondly, there is very high complementarily between rainfall and input use particularly fertilizer application. In the year of deficient rainfall, crop yields go down steeply because of deficient soil moisture and significant reduction in the use of inputs. Moreover, Kharif crops are more sensitive to rainfall when compared to Rabi (post-monsoon) crops.

In the absence of formal risk sharing / diffusing mechanisms, farmers rely on traditional modes and methods to deal with production risks in agriculture (Rutenberg 1976; Collison 1972; Norman 1974; Haswell 1973; Navarro 1977). Many cropping strategies and farming practices have been adopted in the absence of crop insurance for stabilizing crop revenue. Availability and effectiveness of these risk
management strategies or insurance surrogates depend on public policies and demand for crop insurance (Walker and Jodha 1986).

The risk bearing capacity of the average farmer in the semi-arid tropics is very limited. A large farm household or a wealthy farmer is able to spread risk over time and space as he can use stored grains or savings during bad years. He can diversify his crop production across different plots. At a higher level of income and staying power, the farmer would opt for higher average yields or profits over a period of time even if it is achieved at the cost of high annual variability in output (Rao et al., 1988). Binswanger (1980), after studying the risk in agricultural investments, risk averting tendencies of the farmers and available strategies for shifting risk, concludes that farmers' own mechanisms for loss management or risk diffusion are very expensive in arid and semi-arid regions. Since agriculture is faced with risk and uncertainties, farm income fluctuates due to variability in crop yields and commodity prices. This leads to great hardship to the farmers. Even the experience of the Great depression of the 1930s contributed to the view that government policies should be used to reduce uncertainty faced by the farmers in agriculture. Ruttan (1969) summarises this argument:
"The rationale for public intervention in agricultural commodity market is, and will continue to be to lend stability to an industry which technological and economic forces should render chronically unstable in the absence of such interventions". The major role played by insurance programmes is the indemnification of risk-averse individuals who might be adversely affected by natural probabilistic phenomenon. The philosophy of insurance market is based on large numbers where the incidence of risk is distributed over individuals. By offering insurance the possibility of shifting risks, enables individuals to engage in risky activities which they would not undertake otherwise (Ahsan et al., 1982). Individuals cannot influence the nature and occurrence of the risky event. The insurance agency has fairly good but generalized information about the insured. However, this does not hold true in the case of agriculture or crop insurance. Unlike most other insurance situations, the incidence of crop risk is not independently or randomly distributed among the insured. Good or bad weather may affect the entire population in the area.

Lack of data on yield levels as well as risk position of the individual farmer puts the insurance company in tight spot. As in the case of general insurance, agricultural insurance market
also faces the problem of adverse selection and moral hazard. The higher premium rates discourage majority participation and only high risk clients participate leading to adverse selection. Moreover, in crop insurance, the individuals do not have control over the event, but depending on terms of contract, the individuals can affect the amount of indemnity. Tendency of moral hazard tempts an insured individual to take less care in preventing the loss than an uninsured counterpart when expected indemnity payments exceed the value of efforts. The imperfect information (gathering information is costly) discourages participation of private agencies in crop insurance market. Similarly, incidence of random events may not be independent. Natural disasters may severely damage crops over a very large area and the domain of insurance on which it is based crumbles down i.e., working of the law of large number on which premium and indemnity calculations are based breaks down. The private insurance companies of regional nature will go bankrupt while paying indemnity claims unless it spread risk over space.

The natural risks and hazards impinge on the decision-making of the farmers. Crop failure affects the borrowers, creditors and also a vast cross-section of the population. Hence,
Crop insurance can be viewed as an institution of security (Ahsan 1985). Agricultural insurance can encourage farmers to make decisions in allocating their resources and choosing profitable combinations of risky crop enterprises. It also protects the farm against risk from adoption of new production practices, variability in farm commodity and input prices and other related variables that destabilize the farm income levels.

The market orientation of agriculture, on the one hand, undeniably brings prosperity to farmers and on the other; it increases risks in the farming business. 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, fertilisers 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. The new agricultural policy declared by the government recently acknowledges that the condition of the
farmers continues to be unstable due to natural calamities and price fluctuations despite technological and economic advancement. The policy proclaims that an endeavour would be made to provide a package insurance policy for the farmers to insulate them from financial distress caused by natural disasters. Crop insurance is one of the risk management solutions to smooth consumption against income fluctuations. Borrowing by individuals from formal or informal markets smoothens consumption over time whereas insurance smooths consumption across households through risks sharing and risk pooling. Insurance is expected to play a role as collateral security for the asset poor small and marginal farmers in the credit market. 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 vary depending on the nature and extent of protection provided by the scheme.