Introduction: Agricultural Risk Management

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1.0 Problem Statement

The Twelfth Five year plan implementation has begun in India and the country is still searching for a viable strategy to achieve a growth rate of 4% in agriculture while the share of agriculture in GDP continues to decline over the years. In 2012-13, the agriculture and allied sector accounted for only 13.70 percent of the gross domestic product (GDP), at constant 2004-05 prices (Economic Survey, 2013) while it was 19% in 2005, 38% in 1975 and 54% in 1950. However, it is a source of livelihood, income and employment for about 60 percent people in the country.

There is a structural, rising demand-supply gap in Indian agriculture. The roots of food inflation, which hit India in 2008-09 and continued into 2009-10 and 2010-11, can be seen not just in the recent, sudden collapse in agricultural production but more fundamentally in the gradual lowering of potential agricultural growth rate since 2006-07. Therefore, unless there is a breakthrough in food production in the country, the country may revert to the pre-2000 phase of high inflation. The Indian agriculture also suffered from huge underinvestment with Gross Capital Formation in agriculture and allied sectors relative to overall GDP has remained stagnant at around 2.5 to 3.0 per cent. Thus sustainable growth in agriculture sector leading to increased farmers income is the need of the hour.

1.1 Climate Change and Agriculture in India

India is a large country with 15 agro-climatic zones, with diverse seasons, crops and farming systems. Agriculture is the most vulnerable sector to climate change as it is inherently sensitive to climate variability and climate change impacts the country's agriculture in various direct and indirect ways. This obviously means an impact on the lives and livelihoods of millions of Indian farmers and farm labour.

It is reported that about two-thirds of the sown area in the country is drought-prone and around 40 million hectares is flood-prone. The poorest people are likely to be hardest hit by the impacts of climate variability and change because they rely heavily on climate-sensitive sectors such as rain fed agriculture and fisheries. They also tend to be located geographically in more

exposed or marginal areas, such as flood plains or low fertility soils. The rural poor also are less able to respond due to limited human, institutional and financial capacity and have very limited ability to cope with climate impacts and to adapt to a changing hazard burden and elements of vulnerability to climate. Climate change and disasters associated with it mainly affect small and marginal farmers in marginalized locations with social disadvantages to begin with because these farmers have meager resources to buffer them from the new risks that climate change poses for their agriculture.

1.2 Large Pool of Resource Poor Farmers

India has 17% of world's population in less than 2.5 per cent land area. Of this, about 74% of population lives in rural areas and their major occupation is agriculture. According to 2011 census there are about 100 million farmers and another 163 million agricultural laborers. Indian agriculture is predominantly a smallholder's occupation with more than 70 per cent of the farmers categorized as small and marginal farmers with farms of size less than two hectares. Many of them are subsistence farmers and the production capacity of the land for many of them has reached the limit and operates in a complex agricultural system (Figure 1).

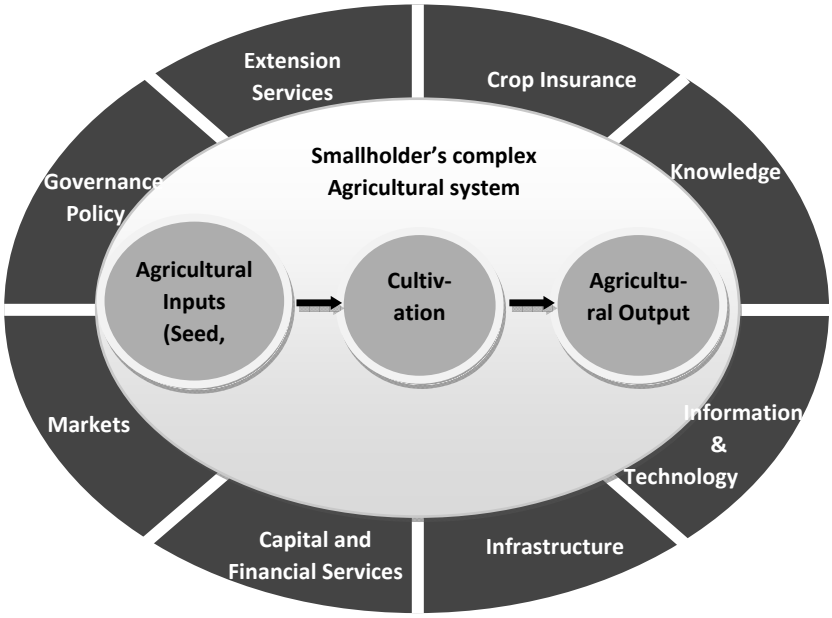


Figure 1: Smallholders operate in a complex agricultural system

Farming is increasingly becoming an unviable activity to small holders because of this nature of landholdings. By and large, it is only the progressive farmers, having large landholdings, who are able to take advantage of various schemes launched by the government. Small and marginal farmers are not able to derive benefits from such schemes due to lack of knowledge, besides there being risks in experimentation. Small and marginal farmers are generally not aware of consequences of the unbalanced use of fertilizers, over use of pesticides or for that matter benefit of soil testing and application of micro-nutrients. Several studies indicate that the major bottlenecks faced by the small and marginal farmers are: lack of access to credit, poor marketing channels for inputs, less developed markets for agricultural outputs, weak extension services, etc. (Singh and Asokan 2005, Planning Commission 2006). The large pool of resource-poor farmers is considered as a continuity force owing to the inability of successive governments in transforming their status from that of subsistence farmers to agri-entrepreneurs. Therefore, it becomes a challenge for the risk management strategy for the agriculture sector to align with the core issue of making farming commercially viable for the large segment of the farming community.

1.3 Towards a Comprehensive Risk Management Policy for Small Holders

The country is large with a geographical area of 329 million ha of which 69 million ha (22.5 percent) are under forest, 42 million ha are (13.7 percent) not available for cultivation and about 28 million ha (9.4 percent) are not under cultivation. One hundred and forty-two million ha of land are under cultivation of which only 53 million ha are irrigated. Since nearly 50 million hectares of area is sown more than once, the cropping intensity works out to 135.1 percent.. The number of landholdings with marginal farmers (less than 1 ha) is 59.4 percent, small farmers (1-2 ha) is 18.8 percent, semi-medium (2-4 ha) is 13.1 percent, medium farmers (4-10 ha) is 7.1 percent and large holding (above 10 ha) is 1.6 percent. Thus the operational holding with small and marginal farmers is about 78.2 percent but the area operated upon is only 32.4 percent. This indicates the need for various agricultural support services to small/marginal farmers. (Haque 2003 and APO, 2004).

Small and marginal farmers face agricultural shocks and risks in variety of shapes and sizes. Catastrophic droughts and floods can destroy productive assets and reduce yields to great extent. Absence of risk management mechanism will easily erode their small savings and force them deeper in to poverty. However, catastrophes are not the only risk faced by farmers. Less devastating, but more frequent, weather events also buffet the agricultural sector. Yields that decline to “only” 60% or 70% of normal

levels may not threaten family survival, but they do destroy limited working capital of the small farmers and threaten their future viability as a commercial producer. Anticipation of such losses forces small farmers into conservative production strategies that limit their growth and income even as they keep risk exposure at manageable levels.

There are immense scales of problems afflicting smallholders which are compounded by their massive numbers, high geographical dispersion, limited awareness, frequent and high levels of exploitation as a political constituency, poor collective organization and low access to support schemes by the Government. The smallholder Investment-earning Cycle is presented in Figure 4.

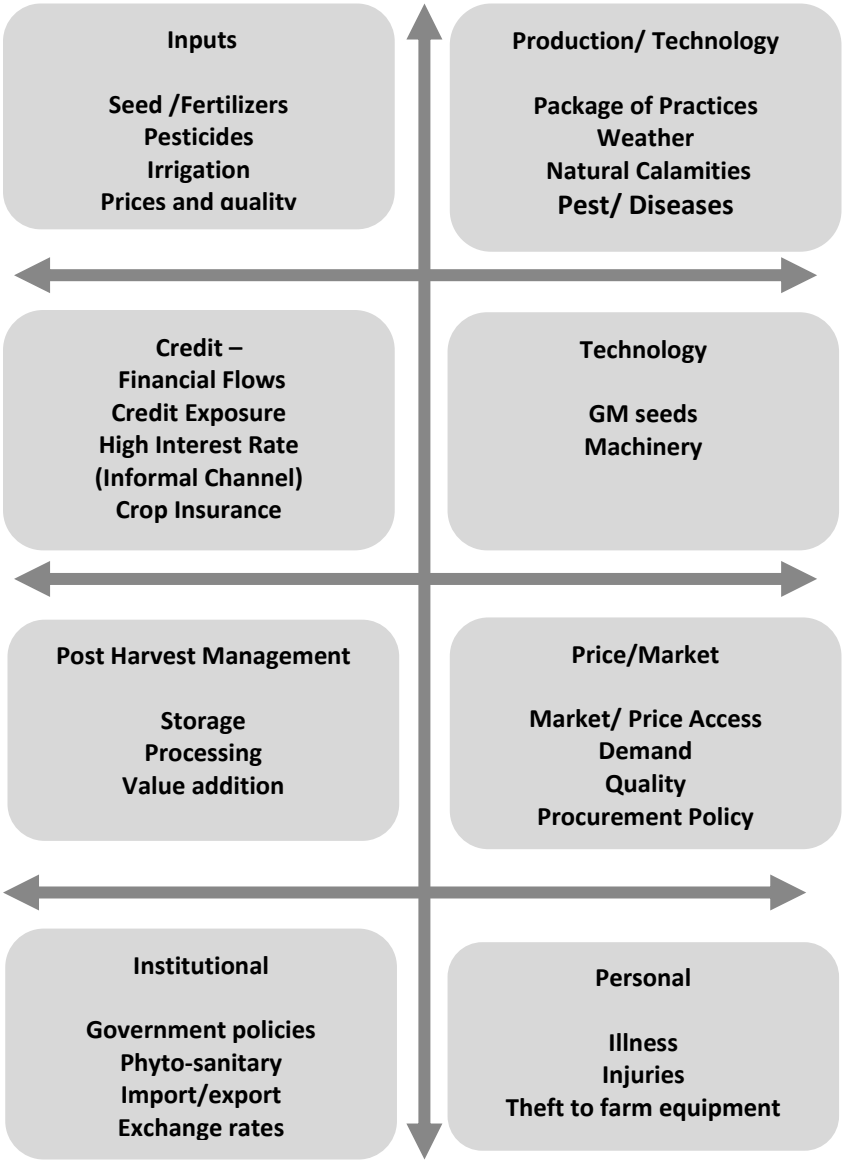
It is therefore imperative to protect the interests of small farmers through measures that help promote and stabilize incomes, reduce risks, and increase profitability by improving availability and access to inputs, markets and credit. . The farmers in India in general and small farmers in particular are exposed to a large number of other risks even in the normal course which do not find a mention risk management frameworks conceptualized for developed countries. These risk sources are neither recognized nor addressed by formal and informal risk management mechanisms resulting in vulnerable farmers shifting production to more conservative, but less profitable modes. The big question is what can be done? The focus so far has been on productivity centric growth wherein technology transfer is the goal without adequate consideration to its adoption by majority of smallholders. In other words, we have to move from current focus on technology dissemination to enabling its adoption. This paradigm shift will be possible if large proportion of risks faced by the farmers in general and smallholders in particular are diagnosed and addressed in a given context.

2.0 Agriculture Risks

Agricultural risk is associated with negative outcomes that stem from imperfectly predictable biological, climatic, and price variables. These variables include floods, cyclones and natural adversities like pests and diseases and climatic changes not within the control of the farmers. They also include adverse changes in both input and output prices. The variability in these factors affecting production can be separated into two – anticipated variations occurring seasonally or cyclically, and those that are unpredictable in nature. Generally, the assessment of risks in agriculture tends to focus on those factors that tend to vary unpredictably (i.e. where variability is uncertain) because anticipated variations can be incorporated into production decisions.

2.1 Types of Agricultural Risks

There are several ways to classify agricultural risks and based on the experience of state of Andhra Pradesh these include the production risk, price or market risk, financial and credit risk, institutional risk, technology risk, input price risk, post harvest management risk, and personal risk and presented in Figure 2.



Types of Risks

(i) Input Price Risk:

Agricultural inputs like seeds, chemical inputs irrigation/power and even the hired labour are the principal sources of production expense, and are often financed through credit. Increasing agricultural productivity depends on the efficient delivery of essential inputs. The risks associated with input use viz. lack of availability and/or timely availability, spurious products, black marketing in the event of supply shortages, non-availability of appropriate product/brand (may happen in case of seed variety and pesticides). The other dimension is increasing cost of purchased inputs including improved seeds at greater financial risks to farmers because input prices have accelerated more than output prices. This finding is supported by the cost of cultivation data generated under the comprehensive scheme of the Ministry of Agriculture.

Given a number of key agricultural inputs are derived from crude oil; fluctuations in oil prices attend to be a major driver for variability in agricultural input prices. It also means that prices for key agricultural inputs (fuel, pesticides and fertiliser) show strong positive correlation (i.e. prices tend to move together), which exacerbates the impact of developments in oil markets on the farm business.

(ii) 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 or yield that the production process will deliver due to external factors because it is largely driven by weather related factors such as rainfall, temperature and pests, and diseases.

In the long term, climate change is an additional source of yield risk through its effects on weather patterns and potentially generating extreme weather events. These may include changing temperature and rainfall patterns resulting in monsoon failures/floods with indirect impacts on water availability and soil moisture. It is observed, however, that changing climate may also result in the introduction and increased frequency of pests and diseases, heightening animal health and crop related risks. In such situation, small and marginal farmers, particularly in rain fed regions who mainly depend on agriculture will be worst affected. Farmers can also be hindered by adverse events during harvesting or threshing that may result in production losses.

(iii) Price or Market risk:

The ultimate purpose of enhancing agricultural productivity should not just include physical output but also consider increased income to farmer. The ability of farmers to obtain reasonable prices for their output, whatever the farm size, is very crucial in addressing farm incomes. Input and output price volatility is important source of market risk in agriculture. Prices of agricultural commodities are extremely volatile and output price variability originates from both endogenous and exogenous market shocks.

Exposure to output price shocks or the ability to cope with them varies across agricultural commodities. Most arable crops, such as grains and pulses, can be preserved and stored allowing farmers more flexibility over when to sell, which provides a mechanism for coping with some of the output price fluctuations (although in some instances there can be significant storage costs). In comparison, other produce, for example livestock products (milk, finished animals and meat), are highly perishable and can only be stored for extended periods at very high costs, which limits the scope to deal with output price Broadly, the market price for agricultural commodities is particularly sensitive to supply shocks due to the generally unresponsiveness of demand for food to price. This means any changes in the level of supply for a particular commodity at any given time requires a relatively large change in price to ensure that market balance is restored or supply equals demand (O'Connor et al 2009).

The length of most agricultural crops range from a few weeks to few months and even several years in case of fruits resulting in a lag between when a farmer makes production decision and the product is sold, which means that output prices are often unknown to farmer at the start of the production cycle. This may lead small and marginal farmers facing many constraints in participating in output markets. Remote locations, poor roads, small volumes of output of varied quality, and little knowledge of market fluctuations tend to localize the effective market and limit the demand for their output, and hence prices received. The economic rationale for a private trader to invest in such remote markets is his ability to pass additional cost on to the producer via lower paid price for the produce. In addition to price access the producers also face market access due to inadequate network of regulated markets and poor transportation facilities.

During market transactions the producers in developing countries suffers the risk of price loss due to lack of methods to objectively, accurately, and efficiently determine the qualities and values of commodities. The state intervenes in commodities markets through the instrument of

Minimum Support Price (MSP) to stabilize farm incomes. However, this policy is not uniformly implemented all over the country leading to distress sale by the producers leading to price loss. Currently outside of a few States the MSP is a purely notional price as far as farmers are concerned. They know that they have the right to sell their food at that price but they have no access to Government granaries or take-in windows where they can sell. The extent of distress sale is driven by his financial needs and sometimes indebtedness.

(iv) Financial and Credit Risk:

The ways businesses finance their activities is a major concern for any economic enterprise but in this respect, agriculture 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 credit and the high cost of borrowing. These problems can be classified as financial risk.

India has perhaps the world's largest network of rural financial institutions, boasting 30,272 nationalized commercial bank branches; 2,934 other commercial banks; 14,241 rural regional bank branches and about 122,000 credit outlets from the cooperative sector which cater to the credit requirements of the priority sector (agricultural and related sectors). With the objective of providing adequate credit to the agriculture sector, the Government framed rules stipulating that 18% of each bank's net credit should be given to the agriculture sector. This was aimed to ensure provision of sufficient and timely credit at reasonable rates of interest to broad spectrum of rural population to achieve increased production and productivity in agriculture. The availability of production credit may help farmers to increase their income but do not reduce his vulnerability or exposure to risks. In reality the coverage by formal sources – Banks, MFIs, and SHGs is only 27% with distinct bias towards households with larger farm holdings. The poor reach of formal sources pushes many farmers to fall prey to the informal money lending system.

The predominance of private moneylenders in credit transactions of farmers is yet another reason why the interest cost shot up by more than fourfold during the post-reform era. The major inadequacies in rural credit include constraints on timely availability of credit, high interest rates and neglect of small and marginal farmers and continued presence of micro finance and informal markets resulting in distortions in interest rates. These inadequacies add to farmers risk in two ways i.e. in terms of higher costs or

yield loss in absence/inadequacy of credit. This is continuously adding to increase in farmers' indebtedness.

(v) Crop Insurance:

Crop insurance is recognized to be a basic instrument for maintaining stability in farm income, through promoting technology, encouraging investment, and increasing credit flow in the agricultural sector. The basic principle underlying crop insurance is that the loss incurred by a few is shared among others in an area, engaged in a similar activity.

The Crop insurance scheme has been going on India since the time of Kharif 1985 and offers financial assistance for risk management in agriculture. However, crop insurance in India still depends upon institutional credit system with very low voluntary participation from non-borrower farmers. Thus the objective of crop insurance still remains only partially fulfilled. The evolution of crop insurance schemes shows the approach of the government towards charging realistic rates of premium from farmers without regard to the fact that the farming activity is not leaving enough surpluses to them to meet the burden. Started at 50% in the beginning the present rate of premium subsidy is just 10% whereas developed countries like the US and Canada provide a premium subsidy of 60% to 70% to all farmers. The coverage of farmers, in the country, has been in the region of 9% to 16%, while the operational area covered did not exceed 4%. With the aggregate claims/premium ratio of 3.33, the burden was not that heavy as it was made out to be. In fact government spends manifold under Rehabilitation Package for Distressed Farmers scheme in 31 suicide prone Districts in the four States, namely, Andhra Pradesh, Maharashtra, Karnataka and Kerala.

Raju and Chand (2008) while analyzing problems and prospects Agricultural Insurance in India observed that despite progress of irrigation and improvement in infrastructure and communication the risk in agriculture production has increased in the country. The risk is much higher for farm income than production, as is evident from lower risk in area and higher risk in production. State wise results show that only in the states where irrigation is very reliable, it helped in reducing the risk. Those states where irrigation is not very dependable continue to face high risk. In some states farmers face twin problem of very low productivity accompanied by high risk of production. As, with the passage of time, neither technology nor any other variable helped in reducing production risk, particularly in low productivity states, there is strong need to devise and extend insurance products to agricultural production.

The lesson to be leant, therefore, is that the actuarial calculations and premium rates decided on the business principles are not relevant for agriculture since most of the farming in India is on small scale and the incomes from farming generally are below subsistence level. So, totally a different approach will be necessary to achieve the twin goals of ensuring the viability of the insurance schemes while protecting both the farming and the farmer.

India is administering the world's largest crop insurance programme in terms of the number of farmers insured. The National Agricultural Insurance Scheme (NAIS) annually insures approximately 18 million farmers, or 15% of all farmers and approximately 17% of all farmed land (Rao,2009). National Agricultural Insurance Scheme (NAIS) with increased coverage of farmers, crops and risk commitment was introduced in the country from Rabi 1999-2000 replacing the erstwhile Comprehensive Crop Insurance Scheme (CCIS). The main objective of the scheme is to protect the farmers against crop losses suffered on account of natural calamities, such as, drought, flood, hailstorm, cyclone, pests and diseases. India is administering the world's largest crop insurance programme in terms of the number of farmers insured. The National Agricultural Insurance Scheme (NAIS) annually insures approximately 18 million farmers, or 15% of all farmers and approximately 17% of all farmed land. The scheme is being implemented by the Agriculture Insurance Company of India Ltd. (AIC). According to Bhaslo (2006) only in Gujarat and Maharashtra more than 10% farmer households have ever insured their crops and incidentally these two states recorded highest agricultural growth in the last decade.

Due to some limitations/shortcomings in the existing National Agricultural Insurance scheme (NAIS), Modified NAIS with improvements has been approved for implementation on pilot basis in 50 districts from Rabi 2010-11 season in the country. Major improvements identified are:

- Bringing the Insurance Unit down to the village Panchayat level so as to minimize the base risk..
- Using a longer time yield series when in fixing the Guaranteed Yield, to ensure more stable coverage.
- Increasing the levels of indemnity (coverage).
- Introducing insurance to prevent sowing/planting and post-harvest losses under adverse conditions.
- In case of major disasters, allowing for the partial settlement of claims on accounts.

- uniform seasonality discipline (cut-off dates for buying insurance) be employed for participation for all farmers, both borrowing and non borrowing.
- Covering horticultural crops such as vegetables and fruits.
- Introducing a gradual shift from an administered price regime to an actuarial one, supported by up-front subsidy as a premium.
- Adopting transparent norms for subsidy premiums with the participation of the private sector participation.
- Sharing of premiums by banks, where lending banks bear 25% of the premium payable by the farmer, subject to a maximum of one percentage point of the premium, for example.

Through these improvements, the Government is expecting to double the penetration of crop insurance schemes by 2012. Select private sector insurers with adequate infrastructure have been allowed (at present, ICICI-Lombard, IFFCO-Tokio and Cholamandalam-MS have been allowed).Only upfront premium subsidy is shared by the Central and State Governments on 50:50 basis and the claims are the liability of the insurance companies. So far 22 States have notified the Pilot MNAIS in 34 districts for Rabi 2010-11 season.

Efforts have been made to bring more farmers under the fold of Crop Insurance by introducing a Pilot Weather Based Crop Insurance Scheme (WBCIS), as announced in the Union Budget 2007, in 20 States. WBCIS is intended to provide insurance protection to the farmers against adverse weather incidence, such as deficit and excess rainfall, high or low temperature, humidity etc. which are deemed to impact adversely the crop production. Weather based Crop Insurance Scheme (WBCIS) operates on the concept of "Area Approach" i.e., for the purposes of compensation, a 'Reference Unit Area (RUA)' shall be deemed to be a homogeneous unit of Insurance. This RUA shall be notified before the commencement of the season by the State Government and all the insured cultivators of a particular insured crop in that Area will be deemed to be on par in the assessment of claims. Each RUA is linked to a Reference Weather Station (RWS), on the basis of which current weather data and the claims would be processed. Adverse Weather Incidences, if any during the current season would entitle the insured a payout, subject to the weather triggers defined in the 'Payout Structure' and the terms & conditions of the Scheme. The "Area Approach" is as opposed to "Individual Approach", where claim assessment is made for every individual insured farmer who has suffered a loss. It has the advantage of settling the claims within shortest possible time (DAC, MOA, 2010-11).

It has been found that the factors such as gross cropped area, income other than agricultural sources, presence of risk in the farming, number of workers in the farm family, satisfaction with the premium rate and affordability of the insurance premium amount influence significantly and positively the adoption of insurance. Kumar etal (2011) has clearly brought out the urgency of developing more innovative products, having minimum human interventions. There is a need for appropriate stakeholders interface and capability building initiatives to enhance adoption of crop insurance scheme and its reach to the target group.

(vi) Institutional Risk:

Another important source of uncertainty for farmers is institutional risk, generated by unexpected changes in policies and regulations that may not directly relate to agriculture but influence farmers' activities. Changes in regulations, financial services, hike in power tariffs, hike in diesel/petrol prices, 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 and phyto-sanitary regulations that can restrict the activity of producers and impose costs on producers. An additional source of financial risk arises from exchange rate fluctuations to agricultural exports and export oriented produce like fruits and vegetables.

(vii) Technology Risk:

Technology in agriculture can be defined as growth in output associated with use of inputs and application of scientific knowledge. Inputs that bring in technological changes in agriculture are fertilizers improved seeds, tractors and other machinery, improved cultural practices and dedicated and trained human labour based on education and training. Technological change in agriculture has far greater role o that 'diminishing returns to scale' are averted. This requires not only both government and private expenditure but its transfer on a sustained basis.

The adoption of new technologies improves productivity and/ or makes farming more efficient, yet there is considerable heterogeneity across farmers in the country with regard to demand of new technologies. Among others, yield variability and the risk of crop failures indeed affect technology adoption decisions in low-income, rain-fed agriculture. The research findings suggests that poor farm households in rain-fed and risky production environments are reluctant to adopt new farm technologies with potential production gain because, at the same time, they involve enormous downside risks. The limited resources most smallholders have leads to limited adoption of the technical packages developed and promoted for

their benefit. Many research findings underscore the fact that productivity gains are necessary, but not sufficient, conditions to attract farmers to adopt new technologies and agricultural innovations. Mere availability of information that a particular technology/technology package would be lucrative may not impress many farmers to try out new technology. Risk implications matter which is reflected in heterogeneity in risk taking potential of small and marginal farmers. They have only very limited options to manage farming risks every year. This holds back investment in their farm, thereby constraining income possibilities. The technology on the other hand follows traditional **"one size fits all approach".** Further, adoption of new technologies in modernizing agriculture such as in introduction of genetically modified crops causes an increase in producer liability risk.

(viii) Post Harvest Management Risk:

Postharvest priorities across the globe have evolved considerably over the past four decades, from being exclusively technical in their outlook and consumer demand to increased farm incomes. A significant amount of the food produced in developing countries is lost after harvest due to poor ***post-harvest management***. The postharvest losses from farm to market are high as a result of poor handling, storage and primary processing e.g. in case of rice it includes drying, milling and storage. Lack of postharvest arrangements exposes farmers to income risk on account of handling losses, poor quality and problems in marketing of produce. The fruit and vegetable sector has a vital role in farm income enhancement, poverty alleviation, food security, and sustainable agriculture in Indi. This sector, however, suffers greatly from postharvest losses. Some estimates suggest that about 30–40% of fruit and vegetables are lost or abandoned after leaving the farm gate. Huge postharvest losses result in diminished returns for producers.

India is the largest producer of fruits in the world, its production per capita is only about 100 g per day. Between 20 and 30% of total fruit production goes to waste owing to spoilage at various steps of the postharvest chain, reducing per capita availability of fruits to around 80 g per day which is almost half the requirement for a balanced diet. The country is the second largest producer of vegetables in the world, ranking next to China, and accounts for about 15% of global vegetable production. Current vegetable production exceeds 71 million MT and the total area under vegetable cultivation is around 6.2 million hectares which is about 3% of the total area under cultivation in the country. It is estimated that between 30 and 35% of India's total vegetable production is lost owing to poor postharvest practices. Developing a vision to reduce postharvest losses in agriculture and facilitate activities within the sector in order to realize that vision will contribute significantly in managing agricultural risks.

(ix) Enabling Environment Risks

These can include political risks, the risk that regulations will suddenly be applied, risks of armed conflict, institutional collapse, and other major risks that lead to financial losses for stakeholders all along agricultural supply chains. Risks can be idiosyncratic—affecting only individual farms (for example, illness of the owner or laborers, acidic soil, particular plant and animal pests and diseases) or covariate affecting many farms and firms simultaneously (major droughts or floods, fluctuating market prices). The high propensity for covariate risk in rural areas is a major reason that informal risk management arrangements break down and that formal financial institutions hesitate to provide commercial loans for agriculture (Jaffee, Siegel, and Andrews 2010).

(x) Personal Risk:

Finally, agricultural households, as any other economic entrepreneur and farmers are exposed to personal risks associated with illness and injuries to 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. Risk Management Initiatives

Farmers have traditionally employed various formal and informal strategies to manage agricultural risk, either before or after the effects of risk are felt. Ex ante strategies (adopted before a risky event occurs) can reduce risk (by eradicating pests, for example) or limit exposure to risk (a farmer can grow pest-resistant varieties or diversify into crops unaffected by those pests). Risk can also be mitigated ex ante by buying insurance or through other responses to expected losses such as self-insurance (precautionary savings) or reliance on social networks (for access to community savings, for example). Ex post strategies (adopted to cope with losses from risks that have already occurred) include selling assets, seeking temporary employment, and migrating. Governments sometime forgive debts or provide formal safety nets such as subsidies, rural public works programs, and food aid to help farms and firms (and their laborers) cope with negative impacts of risky events. Although ex ante measures allow farms and firms to eliminate or reduce risks, reduce their exposure to risk, and/or mitigate losses associated with risky events, they present real and/or opportunity costs before a risky event actually occurs. In contrast, ex post risk management measures respond only to losses that actually occur, but they can have very high real and opportunity costs when that happens.

Farmers make decisions based on their evaluation of risks and the resources at their disposal. Each strategy for managing risk can be carried

out through a variety of instruments, each with different private and public costs and benefits, which might either increase or decrease the vulnerability of individual participants and the supply chain. When selecting a mix of risk responses, it is essential to consider the many links between risk management strategies and instruments (Jaffee, Siegel, and Andrews 2010). To sum up, the agricultural risk management strategies can be classified into three broad categories:

Risk Mitigation

These actions prevent events from occurring, limit their occurrence, or reduce the severity of the resulting losses. Examples include pest and disease management strategies, crop diversification, and extension advice.

Risk Transfer

Risk may be transferred from one entity to another. For instance, marketing risk could be transferred to buyers by way of forward contract. It guarantees to pay an agreed price for the produce to be realized in future. The cost of this alternative is the difference in value of output at post harvest/market price less the value realized at the agreed price. Crop insurance is another example of transferring production risk to another entity i.e., insurance company.

These actions transfer risk to a willing third party, at a cost. Financial transfer mechanisms trigger compensation or reduce losses generated by a given risk, and they can include insurance, reinsurance, and financial hedging tools.

Risk Coping

These actions help the victims of a risky event (a shock such as a drought, flood, or pest epidemic) cope with the losses it causes, and they can include government assistance to farmers, debt restructuring, and remittances. Government and other public institutions, through their social safety net programs, play a big role in helping farmers cope with risk.

There is a distinct role for both public and private institutions in helping smallholders to manage agricultural risk. Private interventions include individual actions and private arrangements among individuals (either informal arrangements or formal, contractual arrangements). Governments have a supporting role to play here, which may include providing infrastructure, information, and a suitable framework for private institutions. As noted, governments and civil society also have a role as providers of safety nets.

Policy Initiatives

As farming today has become the least profitable occupation and in the absence of employment opportunities outside agriculture, the low productivity, low per capita income trap will continue particularly for small farmers. It is time that Indian Agriculture has to move from current focus on technology dissemination **to enabling its adoption.** Efficient risk reducing and loss management strategies such as crop insurance would enable the farmers 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.

The approach suggested in this paper broadly captures in the views of Ex- Governor RBI, Dr. Y. V Reddy, presented during an international seminar that "there is merit in considering a **comprehensive public policy on risk-management in agriculture**, as not only a means of relief for distressed farmers but as an ingredient for more efficient commercialized agriculture. The components of such a policy have to be worked out but illustratively, the public policy could consider some of the elements: First, independent assessment of impact of adverse monsoon conditions and appropriate relief to farmers on an assured basis. Second is to assure farmers a price before harvesting or even sowing through a well regulated network of Forward, Futures and Options markets. Third, implementing liability of suppliers for any shortfall any quality or assured supplies in vital inputs. Fourth, gradually eliminating price subsidies and replacing outlays on risk mitigation for farmers. Fifth is positioning flexibility in extending rural credit with a broad framework of such a comprehensive public policy on risk-management in Agriculture. He suggested a five pronged strategy wherein he talked about "gradually eliminating and replacing price-subsidies with outlays on risk mitigation for farmers in the broadest sense and finally positioning flexibility in extending rural credit within a broad framework of such a comprehensive public policy on risk management in agriculture"(Reddy, 2004).

The working paper also has attempted an in-depth analysis with reference to agricultural risk scenario in India. As stated earlier some of the risks listed in the framework are typical to India. The paper suggests a conceptual model to provide a working strategy and orient research towards specific sets of research questions. In turn the paper is expected to facilitate framing a comprehensive public policy on risk management in agriculture in developing countries with particular reference to India. The working paper also incorporates an important tool namely Risk Exposure Index (REI) for the purpose of planning appropriate interventions and designing market

based insurance products and service models for a given geographical area or agro climatic zone.

Finally, agricultural risk management through efficient deployment of resources in agriculture is the key to increased productivity and farm incomes and to ensure food security. It is possible to improve productivity through a multi- pronged approach without increasing the intensity of resource use by leveraging on improved agricultural risk management of practices in the areas of quality inputs, credit, extension services, technology transfer, insurance, marketing, post harvest management facilities in a framework of public-private partnership by engaging farmers, agriculture and allied departments, banks, insurance companies, NGOs and other stake holding institutions and associations. This framework can be modelled in the shape of a multipurpose cooperative structure which should aim at project based approach to ensure focus on the ultimate objective of improving productivity and increased farm incomes.

References

APO. (2004): Postharvest Management of Fruit and Vegetables in the Asia-Pacific Region. Reports of the APO seminar on Reduction of Postharvest Losses of Fruit and Vegetables held in India, 5–11 October 2004 and Marketing and Food Safety: Challenges in Postharvest Management of Agricultural/Horticultural Products in Islamic Republic of Iran, 23–28 July 2005 Edited by Dr. Rosa S. Rolle, Rome, Italy ©APO 2006, ISBN: 92-833-7051-1 (joint APO/FAO publication).

Economic Survey (2008-09 & 2010-11), Ministry of Finance, Government of India, New Delhi.

Haque, T (2003): Land Reforms and Agricultural Development: Retrospect and Prospect, in S Pal et al (eds.): Institutional Change in Indian Agriculture, NCAP, New Delhi, 267-284.

Jaffee, S., P.Siegel, and C.Andrews (2010): Rapid Agricultural Supply Chain Risk Assessment: - A Conceptual Framework. Agriculture and Rural Development Discussion Paper 47.The Wortld Bank. 1818 H Street, NW Washington, DC 20433.

Kumar D.Suresh, B.C. Barahb, C.R. Ranganathana, R. Venkatrama, S. Gurunathana and S. Thirumoorthya (2011): An Analysis of Farmers' Perception and Awareness towards Crop Insurance as a Tool for Risk Management in Tamil Nadu.: Agricultural Economics Research Review. Vol. 24 January-June 2011 pp 37-46.

Planning Commission (2006), Towards Faster and More Inclusive Growth, An Approach to the 11th Five Year Plan, Planning Commission, Government of India, New Delhi.

Rao, Kolli (2009): N.Risk Management as a Pillar in Agriculture and Food Security Policies - India Case Study Policy Brief. THEMATIC OVERVIEW.EASYPol Module 209. on-line resource materials for policy making Louis BOCKEL Agriculture Policy Support Service, Policy Assistance and Resource Mobilization Division, FAO, Rome , Italy.

Reddy, A.A. (2004): Consumption Pattern, Trade and Production Potential of Pulses. Economic and Political weekly. 39(44):4854-60.

Raju S.S and Ramesh Chand (2008), Agricultural Insurance in India Problems and Prospects NCAP Working Paper No. 8.

Singh G., and Asokan S.R. (2005) Contract Farming in India in R. Chand (Ed.) India's Agricultural Challenges, Centre for Trade & Development, New Delhi.