

CHAPTER – II

**REVIEW OF EXISTING
LITERATURE**

2.1 INTRODUCTION

Although there has been a great concern in the academic, professional, administration and political circles on the aspect of the growing importance of agriculture insurance in Indian economy, there has been little research done so far in evaluating the risk management and measurement process of the agriculture insurance companies/agencies/schemes. As a result there has been a serious gap in this respect and the present research effort is intended to fill up this gap.

Existing insurance literature in India heavily concentrates on life insurance aspects only. However the threads which are available are taken into view. A.N. Agarwal's¹ work on Insurance in India gives a brief description of the history of insurance business in India. In keeping with the objectives of this study, focus has been given on India although there are occasional references to other developing countries.

A few current works have discussed the post – liberalized insurance business in India. Important citations in this regards include Insurance in India: Changing Policies and Emerging Opportunities by P.S. Palande, R.S. Shah and M.C. Lunawat² and An Analysis of the Evolution of Insurance in India by Tapen Sinha³. These studies critically analyses new governmental policies in the insurance sector in India and seeks to predict the opportunities that might come out of these new policies. But these studies also contributed heavily on Life Insurance aspects rather than agriculture insurance in India.

2.2 TRENDS OF AGRICULTURAL PRODUCTION

The international literature is rich with studies on the factors determining the level and trend of agricultural production. A number of these studies identify climatic variations as major influential factors in the agricultural sector. The most that could be deduced from the international literatures are estimates of the impact on certain agricultural commodities on particular countries or states. The researchers find the methodology, data sources and results in these studies worth noting, nonetheless.

Gommes (1999)⁴ of the Food and Agriculture Organization (FAO) identified some of the factors which affect the variability of agricultural yields. Depending on their variations over time, Gommes grouped these factors in three categories: (1) growing smoothly, such as more or less regular technology and management trends (i.e., mechanization, varieties, irrigation, and the farmers' know-how), but growing more abruptly for several years in succession in the case of innovations; a typical innovation was exemplified by the new introduction of irrigation; (2) discontinuous, like extreme factors of various origins and policy decisions which affect management (for instance, farmers may decide to use less fertilizer if it is no longer subsidized) or infrastructure (3) pseudo-cyclic like weather.

Gommes noted that while weather variability remains one of the main factors behind the inter-annual variability of agricultural production, it is hard to estimate how much production is actually lost due to variability under normal circumstances.

He proposed a method to estimate how much production is lost due to climate variability. In a production time series, he takes the maximum production value P_m in the 7-year interval from $Y-3$ to $Y+3$ for each year. Then, he computes the difference between the production P of year Y and P_m and expresses it as a percentage "loss": $(P_m - P)/P_m * 100\%$.

There is, however, a caveat to this method: it implicitly assumes that no marked technological progress took place in the seven-year period. Using his case studies on Thailand, Tanzania, Niger, Mexico, Africa, Italy, France and Canada, he concludes that at regional scale, the largest fraction of inter-annual variability of crop yields and production can be ascribed to technology and management in developed countries while roughly 20% of that variability is due to other factors, of which at least half is weather dependent.

Meinke, Baethgen, and Gimenez (2001)⁵ conducted a study on '*Adaptation of Agricultural Production Systems to Climate Variability and Climate Change*'. They contend that technology plays a crucial role in this type of risk since it can lead to both a reduction in the variation of productivity levels (e.g., introducing irrigation in a water limited environment) or an increase in yield variability (e.g., rain fed systems based on high-yielding cultivars, well fertilized but receiving very variable rainfall). They also identified other types of risk crucial in agricultural production: price or market risks (the change in expected prices after production process began), institutional risks (changes in policies and regulations affecting agriculture), asset risks (damage to equipment, livestock, etc.) and financial risks (fluctuations in interest rates on borrowed capital, cash flow difficulties). Taken altogether, they argued that they affect production variability significantly.

Dilley, R. S. Chen, U. Deichmann, A. L. Lerner-Lam, and M. Arnold (2005)⁶ in association with the World Bank conducted a study on '*Global Hazard Risk Scenario*'. They had sorted out a list of guiding principles on the global risk analysis. They concluded that Agricultural vulnerability to disasters can be reduced by mainstreaming risk management approaches in agriculture and allied sectors. Guiding principles for mainstreaming include:

- ❖ Natural resource base is directly impacted by multiple natural hazards. The impact may be exacerbated in future by long-term climate change and variability.
- ❖ Disasters impact biological input systems, processing and marketing infrastructure, and management practices.
- ❖ Catastrophic risks must be included in macroeconomic projections for countries that are prone to multiple hazards and where agriculture is the dominant economic.
- ❖ Risk communication strategies that supported by the transfer of knowledge and technology to farmers and producers to mitigate risks may have the most tangible impact in loss reduction.

2.3 INDIAN AGRICULTURAL POLICY AND REFORMS

Surabhi Mittal (2007)⁷ made an extensive study on behalf of Indian Council for Research on International Economic Relations (ICRIER), New Delhi, India on the topic **“Strengthening Indian Agriculture- Need for Reforms”**. According to Mittal, ‘strengthening of agriculture will help in upliftment of the farmers but also benefit the larger section of the rural poor who are directly engaged in agriculture or indirectly linked with agriculture as consumers. Efficient way of production, stabilized prices, higher income from agriculture would create a more conjugative environment in the country for the development of the economy as a whole and of rural population in particular.’

Mittal also pointed out in her study that the most important component of the much needed reforms is not only implementation of the policy in time but also simultaneous review and evaluations of the impact of the policies and taking immediate steps to rectify the negative impacts if caused by any of the policies. Inter sectoral linkages and organization of the agricultural sector needs to be taken up. Sustainability is another key issue. In the present context sustainability with natural resource management has become more relevant.

Being a fellow of the ICRIER, New Delhi, Mittal had made another study on the topic **“Past Trend and Projections of Demand and Supply for Major Food Crops in India”**. (June, 2006.)⁸ She suggested that visible institutional changes with new models of marketing and cultivation should be supported by government policies too. Priority investment areas identified need to be worked on without loss of time. Risk management and incentive based system will motivate farmers to efficient agriculture. Empowerment of the small and marginal farmers through education, reforms and development will ensure a better, efficient and strong Indian agriculture.

Ulrich Hess (July 2002)⁹ in association with World Bank published paper on “**Innovative Financial Services for Rural India**”, he described the problems of access to financial services and how monsoon risk affects that access and how India is currently addressing the problems. Hess developed *Monsoon-Indexed Lending* model and suggested that crop loan insurance and risk management scheme can help banks significantly increase their lending volumes, especially in rain-fed areas. At the same time, the scheme can help to bring down default rates as well as transaction costs.

C H H Rao (2005)¹⁰ analyzed agricultural growth from the first decade of the plan period and suggested the continued need for provision of irrigation facilities, strengthening of extension services, developing biotechnologically improved seeds along with adequate supply of institutional credit to raise farm productivity and profitability.

Instability in agricultural production, income, and employment has been a persistent and challenging problem for India and her poor, as analyzed in many of the pioneering writings of Professor C. H. Hanumantha Rao. Professor Rao recognized long ago that there are many methods for removing risk in agriculture and that insurance was only one policy tool.

For example, some risk could be removed with investments in technology and infrastructure, and which might even contribute to increased productivity as well as reduced risk. Where they exist, these options could be superior to investments in crop insurance by either government or individuals.

There have been a large number of studies examining the factors that have contributed to the growth of agriculture in India. **Bhatarai and Narayanamoorthy (2003)**¹¹ had empirically shown that improvement in irrigation and rural literacy are the two most important factors for agricultural growth in India. The findings from this study contribute for methodological development, and for designing an effective and efficient investment and financing policies in irrigation and other sectors of agriculture and rural development in general.

2.4 AGRICULTURAL INSURANCE IN INDIA

The Ministry of Agriculture (2004)¹², in their Report of Joint Group on Crop Insurance, December 2004 highlighted Key Features of the NAIS Program. The Joint Group also provided a series of recommendations to improve the agricultural insurance market in India emphasizing the role of the Government on the reinsurance strategy.

The first wide-ranging study on Indian agricultural insurance schemes was made by P K Mishra (1994)¹³. Mishra analyzed the impact of a credit-linked comprehensive crop insurance scheme (CCIS) on crop loans, especially to small farmers in Gujarat. It was observed that CCIS had a collateral effect as reflected through the increased loan amount per borrower and reduction in the proportion of non-borrowers among small farmers. The implications of credit expansion were that increased availability of credit can enhance input use and output and employment that increased share of small farmers in the total loan can have desirable effects on equity and efficiency considerations. It was also observed that insured households invest more on agricultural inputs leading to higher output and income per unit of land. Interestingly, percentage increase in output and income is more for small farms. Based on 1991 data, CCIS was found to contribute 23, 15, and 29 per cent increase in income of insured farmers in Gujarat, Orissa and Tamil Nadu, respectively (Mishra 1994). It was also found that Access to crop insurance also tended to encourage adoption of riskier but more profitable crops, irrespective of whether such crops are covered by the insurance package or not.

Dr. M. J. Bhende (2002)¹⁴ had made most detailed study on the traditional crop insurance scheme of India. Bhende, had studied the various phases of crop insurance in the country including the various approaches and economic viability of crop insurance. Dr. Bhende also conducted a case study on Karnataka. Dr. Bhende had also tried to identify the problems of Agricultural Insurance in India by analyzing the CCIS and NAIS programmes of the General Insurance Corporation of India.

Vyas and Singh (2005)¹⁵ comprehensively reviewed the NAIS and suggested changes to make it more effective. The paper presented the result of detailed analysis of secondary data. Field investigations were also conducted in five major states, viz, Haryana, Rajasthan, Andhra Pradesh, Madhya Pradesh and Gujarat to assess response of farmers, bankers and other stakeholders such as government functionaries. Besides, field investigations, the authors also relied on discussions with knowledgeable persons like government functionaries from agriculture department, bankers, academicians and farmers representatives in Nagpur, Jaipur and Hyderabad.

Dr. A. Amarendra Reddy's (2004)¹⁶ work on 'Agriculture Insurance in India - A Perspective' examined the on going National Agricultural Insurance Scheme and pointed out the innovative techniques in agricultural/rural insurance, which overcome some of the disadvantages of yield based group insurance and suggests rainfall (weather) index insurance as a better alternative/complement to the existing agricultural insurance scheme.

Satpathy (2005)¹⁷ made a study on traditional crop insurance schemes in india and suggested that the CCIS failed in its basic objective of underwriting the farmer's losses. He criticized the scheme for (a) being financially non-viable, (b) predominantly covering rain-fed crops, (c) excluding important commercial and horticultural crops, (d) covering only loanee farmers, and (e) having deficiencies in the system of crop-cutting experiments and assessment of yield.

The empirical analysis by Turvey and Islam (1995)¹⁸ shows that, on an average, area insurance premiums are much lower than the individual yield insurance premiums, and in terms of efficiency in risk-reduction, individual plans are superior to area plans. Arguments of asymmetric information, which have led some researchers to investigate area versus individual yield insurance, are not totally resolved. Inequities in the benefits of area plans across farmers are not equitably distributed, favoring high-risk producers. Adverse selection causes instability in the pooled contracts which will ultimately cause area insurance plans to fail.

Parchure (2003)¹⁹ commented that 'Whether it was CCIS or NAIS, the performance of the crop insurance scheme in India can only be judged as disappointing on all counts; financial, economic and administrative. Financially, the scheme has been incurring continuous losses... On the economic front too the performance has been pitiable both in terms of the size of the impact of the scheme and equitability of premium collections and claim payments... On the equitability side too one can witness arbitrary cross subsidization... Some crops and regions pay the premiums, others make the claims...

Ramaswami, Ravi and Chopra (2004)²⁰ discuss the issue of risk management in agriculture in a comprehensive manner. Among other aspects they also discuss the risk mitigation strategies at the farmers and community level that can help the households tide over difficulties as a result of a bad year. Some of the risk-reducing strategies at the farmers' level have been crop diversification, inter-cropping, farm fragmentation and non-farm income.

M. Prashad (2007)²¹, Chairman and Managing Director, Agriculture Insurance Company of India Ltd in his paper 'The Speciality of Crop Insurance' (IRDA Journal) examined the Risks in Agriculture and need for Financial Services he concluded that 'in order to ensure protection against financial losses in the farming sector, there has to be a progressive transition from uncertain and informal risk management practices to modern day risk management strategies and Technology – Incentive activities.

The book entitled 'Agricultural Insurance: Role, Importance, Programmes for Multiple Risks and Benefits' written by **Musafir Ray (1994)²²** made a through enquiry into the viability of agricultural insurance in India and it also studied the effects of various factors affecting demand and supply of crop insurance. It analyzed insurability under alternative conditions under the individual yield approach, which was used in most insurance programmes in the world, and the homogenous area yield approach as used in India.

2.5 INTERNATIONAL EXPERIENCES

Richards (2000)²⁵ had studied crop insurance proposals concerned with reforms in the US federal Multiple-Peril Crop Insurance Program for specialty crops. It has raised concerns that a higher cost for catastrophic-level coverage would significantly reduce programme participation.

The demand estimates for three levels of insurance coverage (50%, 65%, 75%) based on aggregate data from grape producers in 11 California counties for the period 1986-96 indicated that the price-elasticity of demand for 50 per cent coverage was elastic, suggesting that premium increases may indeed reduce participation significantly. Such increases may also cause a significant reallocation of growers among coverage levels.

A study undertaken by Torkamani (1998)²⁴ to analyze the effects of agricultural crop insurance on productivity and risk attitude of farmers in Kavar district, Fars province of Iran revealed that technical efficiency of insured group, on an average, was higher compared with non-insured group. The mean levels of technical efficiencies were 73.80 per cent and 65.09 per cent for insured and non-insured groups, respectively.

Mark Wenner (2003)²⁵ in his research paper "Agricultural insurance in Latin America: Where are we? Paving the way forward for rural finance," gave an overview of the agricultural insurance market in Latin America and the Caribbean with some comparative information from selected developed countries by extracting experiences of selected countries with more developed agricultural insurance markets.

Some studies had compared various revenue insurance plans to the US MPCl. Harwood, J., R. Heifner, K. Coble, J. Perry, and A. Somwaru. (1999)²⁶ found the revenue insurance alternatives to be less expensive and more effective at supporting farm income than the yield-based farm policies. They also found that pricing of revenue insurance that a whole-farm based gross revenue plan is generally less costly than a weighted average of individual crop plans.

2.6 NEW INNOVATIONS IN AGRICULTURAL INSURANCE

World Bank (2003)²⁷ indicated that the current approach of risk management through government assistance or informal risk sharing at the community level lacks institutional incentives. It underplays the role of risk financing through ex-ante mechanisms (such as catastrophe re-insurance and contingent credit facilities) that could provide financial liquidity in the aftermath of a natural disaster, and kick-start economic recovery.

Hazell (1992)²⁸ emphasized the problems with traditional crop insurance and recommended using rainfall insurance. Hazell and Skees (1998) participated in the first efforts of the World Bank in returning to crop insurance work. This work was in Nicaragua. Skees and Miranda (1998) followed the work in Nicaragua and this led to the development of the Skees, Hazell and Miranda (1999)²⁹ document.

Hess (2002)³⁰ conducted an initial study and explored the feasibility of weather insurance for Indian farmers to determine if it would be possible to extend the reach of financial services to the rural sector by reducing the exposure to weather risk. The study identified several potential project partners. In response to this study, CRMG, in collaboration with the Hyderabad-based microfinance institution, BASIX, and Mumbai-based insurance company, ICICI Lombard, a subsidiary of ICICI Bank, initiated a project to launch a small weather insurance pilot program for groundnut and castor farmers in the Andhra Pradesh district of Mahabubnagar, the first weather insurance initiative ever to be launched in India.

Hazell and Skees (2005) had published paper on "*Insuring against bad weather – recent thinking*". They had opined for Index based Weather Insurance and also commented that Weather Insurance will be more effective than traditional crop insurance programme.

Ulrich Hess, task manager, and Jerry Skees, Andrea Stoppa, Barry Barnett and, John Nash on behalf of World Bank (2005) conducted a study on 'Managing Agricultural Production Risk Innovations in Developing Countries'³¹. They identified two basic innovations: 1) use of index-based insurance; and 2) layering risk to facilitate risk transfer. They also recognized innovations in agricultural risk management for natural disaster risk, with the focus on defining practical roles for governments of developing countries and the World Bank in developing risk management strategies

Gine Xavier; Townsend Robert; and Vickery James (2007)³² had made similar studies on '*Patterns of Rainfall Insurance Participation in Rural India*'. Xavier Gine (World Bank, DECRG) Robert Townsend (University of Chicago) James Vickery (Federal Reserve Bank of New York) made a group study on smallholder farmers in rural India and predicted that Insurance take up is decreasing in basis risk between insurance payouts and shocks to agricultural income, increasing in household wealth and decreasing in the extent to which credit constraints bind. These predictions match with a simple neoclassical model appended with borrowing constraints. Other patterns are less consistent with the 'benchmark' model. Risk averse households are found to be less, not more, likely to purchase insurance. This paper evaluated participation outcomes using a microeconomic survey of rural households in the Andhra Pradesh region of India implemented after the 2004 Kharif (monsoon season). They also found that social networks play a key role in insurance take up decisions.

K N Rao [IRDA Journal 2007]³³ made a comparative study on Area Yield Insurance and Weather Insurance and argued that '.... while weather insurance may not be the ultimate answer to the erratic weather patterns, it would certainly provide a great stability against the risk that are associated with it.....'.

Jennifer Ifft, (2001)³⁴ in research paper on Government Vs Weather: The True Story of Crop Insurance in India examined the role of the Government in agriculture insurance in India.

Townsend (2005)³⁵ indicated that the current approach of risk management through government assistance or informal risk sharing at the community level lacks institutional incentives. It underplays the role of risk financing through ex ante mechanisms that could provide financial liquidity in the aftermath of a natural disaster, and kick-start economic recovery. They concluded that relief is not enough to restore those most affected to their original economic status. Therefore, risk transfer tools like insurance, in the light of India's disaster vulnerability, are very important.

Roman Hohl³⁶, Director, Agro Australia Asia & Corporate Business, Swiss Re. and **Harini Kannan**, Assistant Vice President, Environmental and Commodity Markets, Swiss Re; made a joint study on Weather Index based insurance products and the paper was published in the **IRDA Journal 2007**. They emphasized that the drawback against traditional agricultural insurance stems from its perceived complexity, high administrative costs and loss adjustment procedures. They concluded that the pressure to increase production and shift toward riskier large-scale monoculture has increased the demand for Index based agricultural insurance in the food industry. They also suggested that stronger incentives for private investments into agriculture marketing and processing, as well as a more liberal handling to establish food processing firms and more contract farming will definitely help the sector to grow with the demand.

Goodwin and Smith, (1995)³⁷ did studies on the price elasticity of agricultural insurance demand. These indicated that the demand of agricultural insurance lacked of price elasticity and that elasticity was between 0.2 and 0.9. Therefore, the marginal subsidy to increase a unit of insured area was very high.

Advances in risk transfer in developed countries are leading the way to solutions to many social problems. **Shiller (2003)**³⁸ documented progress and diagramed a course for far more innovation as the democratization of finance and technologies spur global risk pooling. Shiller commented that Financial and reinsurance markets in developed countries are rapidly devising index-based instruments that allow for the transfer of systemic risks and even of livelihood risks.

Reddy P. Krishna and Syamasundar Reddy (2005)³⁹ in their work on Efficient Implementation of Agri-insurance Schemes by piggybacking eSagu System take into account the agricultural insurance schemes around the world whether an advanced or a developing nation like India that are suffering due to catastrophic losses, and covariate risks They in association with IIT-Hyderabad and Media Lab Asia prepared an IT-based personalized agro advisory system which is being developed to provide high-quality personalized software.

Sidharth Sinha (2004)⁴⁰ published a paper entitled 'Agriculture Insurance in India Scope for Participation of Private Insurers'. Sinha examined different risk management techniques in India. According to Sinha, Government-run crop yield insurance scheme, procurement at minimum support prices and calamity relief funds are the major instruments being used to protect the Indian farmer from agricultural variability.

He suggested that Crop insurance can be improved by increasing the accuracy and timeliness of crop estimation methods, possibly through the use of new technologies. These changes would create the necessary conditions for participation by private insurers. This would need to be supplemented by institutions and operating procedures which enable the private sector to provide agriculture insurance.

Till now there has been a very little effort or no effort on the part of the government or on the part of academics to measure and evaluate the rôle of the Agriculture Insurance in India in general and assessing the accountability and performance of risk management and measurement in particular.

NOTES AND REFERENCES:

1. Agarwal, A. N, "Insurance in India" Allahabad Law Journal Press, 1960.
2. Palande P.S, R.S. Shah and M.L.Lunawat, "Insurance in India: Changing Policies and Emerging Opportunities", Sage Publications, New Delhi, 2003
3. Sinha T, "An analysis of the evolution of insurance in India" Centre for Risk and Insurance studies, Discussion paper series III, 2005.
4. www.fao.org/NEWS/1999/990307-e.htm last accessed on 19 April 2007
5. Meinke, Baethgen, and Gimenez, 'Adaptation of Agricultural Production Systems to Climate Variability and Climate Change', for further details, visit [www.climateadaptation.net/docs/papers/Baethgen Meinke%85z NOAA 2003.pdf](http://www.climateadaptation.net/docs/papers/Baethgen%20Meinke%20NOAA%202003.pdf) last accessed on 24 April 2007.
6. Dilley, R. S. Chen, U. Deichmann, A. L. Lerner-Lam, and M. Arnold, 'Global Hazard Risk Scenario', The World Bank, Washington DC, 2005.
7. Mittal, Surabhi, "Strengthening Indian Agriculture- Need for Reforms", ICRIER, New Delhi, India, 2007.
8. Mittal, Surabhi, "Past Trend and Projections of Demand and Supply for Major Food Crops in India". Background paper prepared for Planning Commission, Government of India, 2006.
9. Hess, Ulrich, "Innovative Financial Services for India: Monsoon-Indexed Lending and Insurance for Smallholders", Agriculture & Rural Development Working paper 9, The World Bank, Washington D.C, 2002.
10. Rao, C H H and Ashok Gulati, 'Indian Agriculture: Emerging Perspectives and Policy Issues' in selected papers by C H H Rao, Academic Foundation, New Delhi, 2005.
11. Bhattarai, M and A, Narayanamoorthy, "Irrigation and other Factors Contribution to the Agricultural Growth and Development in India: A Cross-State Panel Data Analysis for 1970 to 94" <http://www.iwmi.cgiar.org/Assessment/Publications.htm> last accessed on 24 April 2007
12. GOI, Ministry of Agriculture 04, Report of Joint Group on Crop Insurance, December, 2004
13. Mishra, P.K, "Crop Insurance and Crop Credit: Impact of the Comprehensive, Crop Insurance Scheme on Cooperative Credit in Gujarat." Journal of International Development, vol. 6(5) pp. 529-568, 1994.

14. Bhende, M.J, "An Analysis of Crop Insurance Scheme in Karnataka". Agricultural Development and Rural Transformation Unit, ISEC, Bangalore, 2002.
15. Vyas, V S, Surjit Singh, *Agricultural Crop Insurance: Performance and Needed Reforms*, Report submitted to Agriculture Insurance Company of India, 2005.
16. Reddy, Dr. A. Amarender, "Agricultural Insurance in India-A Perspective" 6th Global Conference of Actuaries February 18-19, New Delhi, 2004.
17. Satpathy, A, "Managing risks of informal workers: role of micro and public insurance programmes" <http://www.digitalopportunity.org/article/view/113528/1/8062>, last accessed on 19 April 2007.
18. Turvey, Calum and Islam Zahirul, "Equity and Efficiency Considerations in Area versus Individual Yield Insurance" *Agricultural Economics*, Volume 12, Issue 1, April 1995, pp. 23-35, 1995.
19. Parchure, Rajas, "Varsha Bonds and Options - Capital Market Solutions for Crop Insurance Problems", Balewadi, Pune: National Insurance Academy, Mimeo, 2003.
20. Ramaswami, B., S. Ravi and S. D. Chopra, "Risk Management in State of the Indian Farmer: A Millennium Study", Academic Foundation, New Delhi, 2004.
21. M, Prashad, "The Speciality of Crop Insurance", *IRDA Journal*, vol. VI, no. 1 pp. 14-16, 2007.
22. Rai Musafir, *Agricultural Insurance: Role, Importance, Programmes for Multiple Risks and Benefits*, Deep & Deep Publications, New Delhi, 1994.
23. Richards, T.J, "A Two-Stage Model of the Demand for Specialty Crop Insurance", *Journal of Agricultural and Resource Economics*, vol. 25(1), pp: 177-194, 2000.
24. Torkamani, J, "Effects of Crop Insurance on Technical Efficiency and Risk Attitude of Farmers: An Application of Stochastic Frontier Production." *Iranian Journal of Agricultural Sciences*, vol. 29(1), pp.161-69, 1998.
25. Wenner M and Arias D, "Agricultural insurance in Latin America: Where are we? Paving the way forward for rural finance." An International Conference on Best Practices, Inter-American Development Bank, 2003.
26. Harwood, J., R. Heifner, K. Coble, J. Perry, and A. Somwaru, "Managing Risk in Farming: Concepts, Research, and Analysis." Economic Research Service (ERS), U.S. Department of Agriculture. 1999.
27. World Bank, "Financing Rapid Onset Natural Disaster Losses in India: a risk management approach" [Report no. 26844-IN.] Washington DC, World Bank, 2003.

28. Hazell, P.B.R, "The Appropriate Role of Agricultural Insurance in Developing Countries." *Journal of International Development*, vol. 4 pp. 567-581, 1992.
29. Skees, J. R., P. B. R. Hazell, and M. Miranda, "New Approaches to Crop Yield Insurance in Developing Countries." *International Food Policy Research Institute: Environment and Production Technology Division Discussion Paper No. 55*, 1999.
30. Hess, Ulrich, "Innovative Financial Services for India: Monsoon-Indexed Lending and Insurance for Smallholders", *Agriculture & Rural Development Working paper 9*. The World Bank, Washington D.C, 2002.
31. World Bank, "Managing Agricultural Production Risk: Innovations in Developing Countries", *Agriculture and Rural Development Department, World Bank, Washington DC*, 2005.
32. Xavier, Gine, Townsend Robert and Vickery James, "Patterns of Rainfall Insurance Participation in Rural India" *World Bank, Washington, DC*, 2007.
33. Rao, K.N, "Weather based Crop Insurance Panacea or Providence?", *IRDA Journal*, vol. VI, no. 1, pp. 22-24, 2007.
34. Ifft, Jennifer, "Government Vs Weather: The True Story of Crop Insurance in India", *Research Internship Papers, Centre of Civil Society*, 2001.
35. Townsend, R, "Weather Insurance in Semi-Arid India." Paper prepared for the *CRMG, Agricultural and Rural Development Department, ESW, The World Bank, Washington DC*, 2005.
36. Hohl Roman and Harini Kanan, "Green Field for Agricultural Insurance: Huge Potential in India", *IRDA Journal*, vol. VI, no. 1, pp. 17-19, 2007.
37. Goodwin, B. and Smith, H, "The Economics of Crop Insurance and Disaster Aid", *The AEI Press*, 1995.
38. Shiller, R. J, "The New Financial Order: Risk in the 21st Century", *Princeton, Princeton University Press*, 2003.
39. Reddy P. Krishna and Syamasundar Reddy (2005), "eSagu Web based Agricultural Expert Advice Dissemination System", *Final Evaluation Report, IIIT, Hyderabad, April 2005*
40. Sinha, S, "Agricultural Insurance in India: Scope for Participation of Private Insurance", *Economic and Political Weekly, Vol.39, No. 25*, pp. 2605-2612, 2004.