Farmers' Perception on Risk and Management Strategies in Mahanadi River Basin in Odisha: An Economic Analysis

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Abstract

sing primary data from Mahanadi River Basin of Odisha, the present study examines the risk perceptions, management strategies and their relationship with farm and farmer characteristics A total of   farmers were interviewed from three districts, namely, Sonepur, Boudh and Kendrapada, which are in upper   , middle   and lower   region of Mahanadi River Drought   was perceived as the most important source of risk in   pper Mahanadi region, inade uate government support, including crop insurance,   in middle Mahanadi region and flood   in lower Mahanadi region The important risk management strategies followed by pper Mahanadi region farmers was varietal diversification   of the same crop specifically paddy while it is crop diversification in middle mixed cropping   and lower Mahanadi region   The result of Multiple regression analysis shows that risk perception of the farmers of these three regions were influenced by social groups, off farm income, ratio of earning member to the household size, farm size, land ownership status and government support The regression results of management strategies are almost similar with the results of risk perception, social group, ratio earning member to the household size, land ownership status, age, off farm income and farm size have a significant influence on the management strategies across the three regions

Keywords Perceptions of risk, Risk Management Strategies, Farmers, Multivariate Analysis, Odisha, India

Introduction

The concept of risk and uncertainty is all about future expectations, which are associated with the probability of unexpected loss Dallas,   Besides, it is widely viewed as a complicated factor which influences decision making under uncertain conditions and its outcome in the future   ardaker,

Risk and uncertainty are more prominent in agriculture than in industry Agriculture is exposed to several types of risks, starting from the field to the market A farmer must take decision under different types of vulnerable and uncertain situations These vulnerabilities arise due to natural hazards, market fluctuations, social uncertainties, State actions and wars   llis,   Therefore, most of the farmers endow some extra time and capital to develop appropriate adaptive measures to tackle these risks

Agricultural risks in developing countries mainly occur due to the difference in geographical regions, regular natural hazards, erratic climatic condition, seasonality in farm production, pest and diseases, fluctuating market demand for agricultural commodities, fluctuation in input and output price, inade uate financial support in terms of credit and insurance during re uirement by the government Akhtar *et al*,   These risks directly affect the agricultural production which further affects the income and the livelihood of farmers Since agriculture is the main source of income for farmers, it is

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very important to identify the risks faced by farmers and their management strategies Drollette,   ,
Akhtar *et al*,

India is the second largest populous country in the world Maintaining food security for the
huge population is the main concern of the country In such a scenario, if farmers behave as risk
averse, then the resource will be misallocated and it will further reduce the overall welfare of the
society On the other hand, if farmers behave as risk neutral, then their production decisions would
affect the expected marginal productivity Akhtar *et al*,   Therefore, the Government should
understand the exact situation and implement appropriate policies or programmes to increase farmers
risk taking capacity In this context, it is very important to understand the sources of agricultural risk
that farmers face   nderstanding these sources of risk will help the farmers in taking appropriate
management strategies For examining farmers behaviour in uncertainty, it is necessary to know
farmers perception towards risk Lucas and Pabuayon,   Perceptions of sources of risk act as a
starting point for taking decisions on risk management Perception towards risk also influences the
investment and business decisions under uncertainty Akcaoz and Ozkan,   Similarly, in agriculture
sector, risk perception influences farmers risk attitude and management decisions   insen *et al*,
A farmer takes decisions according to his perception towards risks   eber and   see,

This study examines farmers perception towards agricultural risks, management strategies and
their relationship with socio economic characteristics Risk perception and management strategies
significantly differ on the basis of age, years of education Kammar and Bhagat,   Bishu *et al*,
number of earning members Ayinde,   , social group Ahsan,   on religion , land
ownership status Flaten *et al*,   , depending on other farm activities like dairy and poultry Le
Bihan *et al*,   , farming experience Lucas and Pabuayon,   , off farm income Flaten *et al*,
Bardhan *et al*,   Ahsan,   I bal *et al*,   Asravor,   , farm size Feder,
I bal *et al*,   , distance to market Akhtar *et al*,   , market information Asravor,   , bank
loan Lucas and Pabuayon,   and government support Bardhan *et al*,   Amaefula *et al*,
These studies have examined the risk perceptions, management strategies and their relationship with
socio economic characteristics of agricultural, livestock, and fishery farmers These studies showed
mixed either positive or negative results on socio economic characteristics on risk perceptions and
management strategies relationship Status of this relationship varies due to difference in social,
demographic and economic features Nevertheless, these studies provide valuable insight to the policy
makers and farmers

In the Indian context, such studies on agricultural risks are limited Bardhan *et al*
Murthy *et al*   Ramaswami *et al*   Panneerselvam *et al*   Singh *et al*   are
recent studies in India These studies mostly focussed on climate related risk and their adoption
strategies Moreover, these studies have not investigated the issues of production, market and financial
risk in detail, with respect to India Remaining risks, like market and financial aspects, are very crucial in
developing countries Studies on these aspects are very meagre in the context of India   ence, an in
depth study on financial and market risk in the context of developing country is crucial

This paper attempts to study the risk perception of farmers from Mahanadi river basin of
Odisha, India It further examines the determinants of risks and the risk management strategies

followed by them The findings of this study are expected to help the government in developing better policies and thereby facilitate the farmers in taking appropriate management strategies under various uncertain situations The findings of this study will also aid policy makers to fine tune government policies and programs towards management of agricultural risks in Odisha State of India

The rest of the paper is organised as follows section two presents the theoretical framework of the study, the third section discusses the methodology, the fourth section explains the results and the fifth section concludes the paper

Background about Odisha Agriculture

Odisha is a state of India where about   per cent of the population are agriculturalist and the contribution of the sector to the Gross State Domestic Product GSDP is only   per cent GoO,   This is because of the low per capita income in the agricultural sector The main cause for low production and per capita income in this sector is due to fre uent occurrence of natural hazards like cyclones, flash floods, drought and heat waves etc   Chittibabu *et al*,   Patnaik *et al*,   Bahinipati   Patnaik,   Natural disasters are common in Odisha It has been recorded that over   years   to   years were affected by natural hazards GoO,   The main reason for these calamities is heavy or scanty rainfall Rainfall plays a vital role among the agricultural producers because most of them are rainfed cultivators These cultivators fully depend on nature starting from sowing to packaging It is well known that occurrence of rainfall in very uncertain, therefore the production and income of a farmer is also uncertain This uncertainty not only encourages production risk but also their income risk, market risk and financial risks In order to tackle these risks and to encourage the farm producers for more agricultural investments, both state and central governments have implemented many schemes like crop insurance Pradhan Mantri Phasal Bima   ojna , subsidies in the form of cash and kind e g seed, agricultural e uipment, fertilizer, irrigation credit, power subsidies etc , crop loss compensation, training programmes, pest management plan, soil health management plan etc Likewise, farmers from the state have also taken various coping up strategies like financial management, on farm management, off farm management etc in the highly vulnerable regions of Odisha Roy *et al*,   Bahinipati   Venkatachalam,   According to Bahinipati   farmers from the flood prone region adopt risk management strategies like flood and salt tolerant traditional paddy seeds like Padma, Bhaluki and Raspanjar etc , re cultivation of seedling and re planting, mixed paddy both traditional and   V seeds cropping, crop diversification, pest and disease management soil conservation trough soil tillage or using gypsum etc techni ues and land holiday keeping a piece of land fallow   Further, Patnaik *et al*   reported the use of credit or borrowing, selling household assets and livestock, and receiving remittances from migrant members were the most adopted management strategies of the coastal region farmers from Odisha

Theoretical Framework

 xpected utility theory is commonly used for the purpose of descriptive and normative aspects in the decision making analyses by economists It is widely known as normative model, where the decision maker is assumed to be fully rational and always tries for the highest expected outcome Schoemaker

and ershey, This theory, derived from expected utility hypothesis, depicts how a person should make decisions under uncertainty Pennings and Smidts This theory depends on the probability and conse uences of an outcome while an individual generally takes decision according to the probability of an outcome

According to this theory, the results of risk attitude analysis using different procedure should come with identical results owever, empirical analysis suggested unidentical results across methods MacCrimmon and ehrung In the case of probability outcome estimation, individuals do use heuristics mental shortcuts rather using mathematical formula like Baye s rule Tversky and Kahneman Lichtenstein and Slovic found a fundamental disparity between gambling decisions and lottery choices hile, Kirchler, Maciejovsky and eber suggested certainty e uivalents and binary lottery choices elicitation methods were poorly corelated with each other Because of which expected utility theory was highly criticised on descriptive grounds by many economists since it had problem in explaining the observed behaviour risk perceptions of an individual Kahneman and Tversky Allais, MacCrimmon and ehrung Further findings from the experimental method depicted that an individual perceives differently towards same possible outcomes of an event according to his her subjective judgement

Perceptions of an individuals decision is a subjective phenomenon because it is associated with unknown factors in it MacCrimmon and ehrung Perceptions of an individual remain same subjective in the case of known risk factors because of its personalised nature of probability of loss determinations There are some decision making behaviour which cannot be explained by expected utility model for solving this ambiguity conomists like Kahneman and Tversky, Shapira, Sitkin and Pablo proposed subjective aspect of decision making approach For this subjective decision making approach, understanding risk perceptions of an individual and its determining factors is very essential because of its significant impact on decision making behaviour Rabin and Thaler

This study uses van Raaij descriptive model, where economic behaviour of an individual with subjective goal of well being in mind is determined by perceptions of an individual about economic environment Lien *et al*, This model shows the impact of farm and farmers characteristics i e age, education, income level, farm size on farmers perceptions towards risk It also examines the combined impact of farm farmers characteristics and perceptions towards risks on the economic behaviour of farmers i e risk management strategies Many economists like Flaten *et al* Bardhan *et al* Ahsan, I bal *et al* Asravor, used this model to show the influence of farm and farmers characteristics, risk perceptions on risk management strategies and came out with interesting results This paper also attempts to explain the relationship between farm farmer characteristics, risk perceptions and management strategies by using van Raaij s model Figure illustrates the modified version of Van Raaij s economic psychological model This figure only uses those variables which are relevant for the study owever, the other variables of Van Raajis model have been excluded from this study In this figure, P refers to personal characteristics of socio economics P refers to the business environment as perceived by the farm entrepreneurs B refers to economic behaviour of farmers The causal link is denoted by P P which shows the impact of

socio economic characteristics on perceptions of farm entrepreneur P Again, the causal link denoted by P   P B shows how personal characteristics and perception towards risk affects farmers economic behaviour like investment decisions and risk management strategies

Figure 1: Van Raai 's Model of Economic-Psychological Relationships
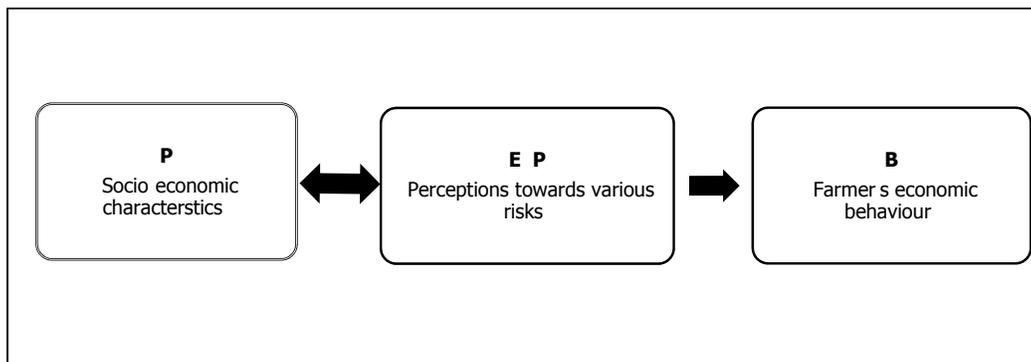
Materials and Methods

Summary of Location

Odisha is a state which is in the eastern part of India It has a land area of , ,   s uare kilometres and is broadly divided into four geographical regions, namely, Northern Plateau, Central River Basins,   astern ills and Coastal Plains based on geological and climatic conditions This State has a long coastline of   kilometres and because of this, it faces multiple natural disasters Annual reports on natural calamities   , GoO stated that western districts are prone to droughts, the coastal districts are prone to high floods and cyclones in the state Odisha has experienced cyclones and floods for about   years between   and   The State also faces other natural disasters like earth uake, heat waves and fire accidents The Annual Reports on Natural Calamities ARNC GoO   found that about   per cent of the State is disaster prone Agriculture is the principal source of livelihood for the people of Odisha and rainfall is the main source of water for agriculture Odisha has been selected as the study location because of its fre uent flood situations Annual reports on natural calamities GoO,   show that Odisha has experienced flood every year since   Flood in coastal part is mainly brought about by the five important rivers, namely, the Subarnarekha, Burha Balanga, Baitarani, Brahmani and Mahanadi and their tributaries in Odisha Besides, drought is a common feature mostly in   estern parts of Odisha which has been experienced in almost every alternate year

Data

The present study uses primary and secondary data The, secondary data on farmers were collected from district agricultural offices while the primary data were collected through structured uestionnaire and in depth interview Sample households were selected from three flood affected districts of Odisha, namely, Sonepur, Boudh and Kendrapada which are in upper, middle and lower region of the Mahanadi River respectively This paper analyses the data on farmers residing in these three regions

A seventeen page uestionnaire was prepared which contained uestion related to farm and farmers charactestics, farmers perceptions towards production, market and financial risks and farmers perception towards various management strategies The uestionnaire related to farm farmers characteristics are mainly dichotomous uestions which contains yes or no type responses The uestions related to risk perceptions and management strategies contain close ended uestions which were in the form of five point Likert scale type The uestionnaire was pre tested and refined according to the suggestions and comments given by the farmers during a pilot survey

Information on the sampled farmers were collected from Special Relief Commissioner SRC , Odisha, where they registered their name for availing crop damage compensation and reliefs from government Secondary data related to their farm, cropping details, receipt of government support was collected from district agricultural offices Sonepur, Boudh and Kendrapada

Sample

A multi stage random sampling techni ue has been followed for selecting districts, blocks, Gram Panchayats, villages and respondents in this study According to flood data, nearly districts of Odisha were affected by flood ARNC GoO In the first stage, three districts out of the flood affected districts have been selected In the second stage, three flood affected blocks were randomly chosen from these districts In the third stage, nine revenue villages from each block were selected randomly In the final stage, to respondents were interviewed from each of these villages Primary data was collected from a total sample size of , out of this, farmers were from upper region, famers from middle region and farmers from lower region The primary data was collected for the agriculture year Farmers of the regions were very cooperative and friendly Before conducting the survey, I visited the sampled villages and built personal relationship with the respondents so that it can be helpful during actual interview

Analytical Techniques

Compilation and analysis of data has been carried using descriptive statistics and factor analysis Information on socio economic characteristics have been analysed by using descriptive statistics table

Farmers perceptions towards risk and perceptions of management strategies were analysed through factor analysis

Factor analysis has been employed to find the reduced number of factors by summarising the information air *et al*, As a rule of thumb, only factors with latent root criterion igenvalue greater than one has been considered in this study Orthogonal varimax rotation was implemented in order to minimize the number of variables that have high loadings on each factor to obtain factor solutions that were easier to interpret In addition, Kaiser Meyer Olkin KMO measures sampling ade uacy was used to check the factorability of the correlation matrices The KMO value varies from zero to one here, one indicates that each variable is perfectly predicted without error by the other variables KMO result of or greater was recommended in this study Stevens air *et al*,

Multiple regression analysis has been used to examine the relation between socio economic characteristics, perceptions of risk and risk management strategies Before running multiple regressions,

a preliminary analysis was carried out for all the multiple regressions to verify that there is no violation of assumptions Normality, heteroscedasticity and multicollinearity test were conducted to ensure the appropriateness of the model No multicollinearity and heteroscedasticity problems were detected

Results and Discussion

Socio-economic characteristics

Table shows the descriptive statistics on socio economic features of sample farmers They are classified in terms of age, years of education, ratio of earning members to the total family size, social groups, years of experience, farm size, off farm income, ownership of the land, other farm activities, bank loan, outstanding debt in bank, government support, market distance and market information This information is used as determinants of perception of sources of risk and management strategy components obtained from factor analysis using the multiple regression analysis Average ages of the farmers of the three regions upper, middle and lower were , and years, respectively xperience in agriculture of the farmers of three regions was , and years, respectively The ratio of earning members to family size was more than per cent in all the three regions Average size of the farm household in upper region was about acres, acres in the middle region and acres in upper region It is to note that nearly per cent of farmers from upper region, per cent from middle region and per cent from lower region belong to general and other backward categories OBC

Average years of education of the farmers of three regions were , and years, respectively About Rs , income generated from off farm activities in upper region, Rs , in middle and Rs , in lower region annually Nearly to per cent farmers were depending upon bank loans in the three regions Nearly per cent of upper region farmers opined that they had outstanding loan in the bank, whereas farmers from middle and lower regions opined they also had outstanding loan in the banks Nearly per cent of the farmers from upper and middle regions depend on government support like irrigation facilities and input subsidies, while per cent farmers from the lower region depends on government support Average distance to main market from the village for three regions was approximately to kilometres Nearly per cent of the farmers from three regions avail information about the market from friends, relatives and known retailers

Table 1: Socio-economic Features of Sample Farmers

Variable Name	Variable Definition and Measurement	Average		
		Upper Region	Middle Region	Lower Region
Age years	Continuous			
ducation years	Continuous			
Ratio of earning member to the family size No	Continuous			
Farming experience years	Continuous			
Average annual off farm income INR	Continuous	,	,	,
Farm Size Acre	Continuous			
Irrigated	Continuous			
nirrigated	Continuous			
Distance from the market KM	Continuous			
Social group	Dummy takes the value if general and OBC and , otherwise			
Land ownership status	Dummy takes the value if self owned and , otherwise			
Other farm activities	Dummy takes the value if off farm activities and , otherwise			
Availed credit from bank	Dummy takes the value if taken credit from banks activities and , otherwise			
Government support	Dummy takes the value if crop insured activities and , otherwise			
Outstanding loan in the bank	Dummy takes the value if they have outstanding loan and , otherwise			
Market information	Dummy takes the if accessible of market information and if not			

Source Authors calculation from primary survey for the agriculture year,

Farmers perceptions towards various types of risk

The result of factor analysis on farmers perception towards various risk for upper, middle and lower region were shown in table I, II and III see Appendix   Table contains both mean values and factor loadings The mean values were in decreasing order and the factor loadings are above the threshold level i e greater than   per cent   xploratory factor analysis   FA has been used to reduce the variables into smaller number of factors Six to seven major factors were obtained from   sources of risk that were identified from farmers of upper, middle and lower region These factors explain about   upper ,   middle and   per cent lower of the total variance These factors were production risk, credit risk, market risk, input cost, land risk, flood risk, catastrophe and cashlessness From among these factors, credit risk contains higher loading in upper and lower region whereas production risk for middle region

It can be clearly seen from table I See Appendix that drought   and shortage of cash on hand   were the most important sources of risk in the upper region whereas the least important factors were product   uality re uirement of traders In the middle region, inade uate governmental

support, specifically crop insurance   , was the most important and change in land prices was the least important source of risk Table II, See Appendix For the lower region, water logging   and inade uate government support specifically crop insurance   were perceived as most important and change in land price as least important sources of risk Table III, See Appendix

In upper Mahanadi region, factor   can be named as credit risk It contained five variables which are related to finance issues This factor explained about   per cent of the total variance Input cost Factor   contains six input and its cost related variables which was clearly shown in table I See Appendix   All the variables were positively related to this factor Factor   can be summarised as market risk because it contains five market risk related variables Factor   can be named as flood risk which includes the high factor loading of flood related variables Table I, See Appendix   Cashlessness Factor   contains three variables, namely, shortage of cash on hand, lack of savings, inade uate government support, including crop insurance, which had a positive relation with it Factor   production risk had a positive relation with the yield influenced variables, namely, drought, pest diseases, unfavorable weather condition during crop cycle and weeds

In the middle Mahanadi region production risk Factor   contained nine variables, namely sand casting, water logging, drought, soil erosion, unfavourable weather condition during crop cycle, surface runoff, pests and diseases, weeds and sediment loading, which had a positive relation with it Table II , see Appendix   This factor explains about   percent out of total variance For this region, farmers production risk was main source of risk Factor   was named as credit risk which contains five finance related risk variables Market risk factor   had a positive relation with product   uality re uirement of traders, lack of alternate markets and transportation problem, which were market related risk variables Factor   can be summarized as input cost It contains four input related variables Factor   cashlessness contains three variables whose values were greater than   Land risk factor   contains two land related variables such as landlessness of family member within joint farm household   and changes in land prices

Table III see Appendix represents the varimax rotated factor loadings of risk source in lower Mahanadi region farmers Credit risk factor   in the table III contains five variables with higher scores namely lack access to institutional credit   , indebtedness   , credit ceiling based on land   , delay in access to institutional credit   and varying institutional interest rates Finance related risk was very high in this region due to unavailability of financial institutions and poor facilities from thm to the farmers It was also due to unavailability of appropriate facilities for tenant farmers They were unable to avail the bank facilities due to unavailability of owned land Factor   market risk also contained five market related variables which has positive relation with the factor Factor   flood risk consists of five variables which were having high loadings greater than   table   Factor   can be named as input cost because it contained four input related variables Cashlessness factor   had a positive relationship with the variables like inade uate Government support including crop insurance   , shortage of cash on hand   and lack of savings   Factor   catastrophe had a high loading of four natural hazard related variables Land risk factor   was having high loadings of land risk related variables

Farmers perceptions towards Management strategies

Result of factor analysis on risk management strategies of upper, middle and lower Mahanadi region was presented in table IV, V and VI See Appendix   Factor analysis obtained four factors from   risk management strategies in all the three regions   These factor loadings were greater than one   igenvalues explains about   ,   and   per cent of total variance for upper, middle and lower regions, respectively

Growing more than one variety of the same crop s   was the most effective strategy, while selection of crop varieties with low price variability   was the least effective strategy in the upper region Table IV, See Appendix   In the middle region, growing more than one crop like paddy and green gram, paddy and black gram   was considered as the most practiced risk management strategy and practicing lift bore well irrigation   as the least important strategy   Table V, See Appendix   It can be clearly seen from Table VI See Appendix that crop diversification   was the most influential risk management response for the lower Mahanadi region farmers, whereas government financial support   was the least important management strategy

Table IV See Appendix   represents the four obtained factors from the factor analysis in the upper region Those factors can be named as diversification, credit reserves, marketing and off farm activities Factor   had high loadings of growing more than one variety of the same crop s, lift borewell irrigation, re cultivation of seedlings, using traditional flood resistance crop, pests and diseases control, hiring labour on need basis, crop diversification, cultivating in Rabi and Summer season instead of Kharif and growing more than one crop and named as diversification Factor   was named as credit reserves as it contained with arrangement of money from friends and relatives, depending on precautionary saving, leasing assets rather than owning them, depending on MGNR GA, management of debt and dependent on government financial support Factor   contained high loadings of four market risk management variables, hence, it was named as marketing Factor   was summarised as Off farm activities because it was highly loaded with four off farm risk management strategy variables

Table V See Appendix   represents the Varimax rotated factor loadings of risk management strategies for middle Mahanadi region   It was clear from the table that factor   diversification containing nine management strategies related to diversification, which were having highly loaded factor scores Factor   was constructed as marketing as it contained with spreading sales over time by storing product through gathering market information, spreading sales among retailers and selection of crop varieties with relatively lower price variability Factor   was highly loaded with credit risk management strategies and hence was named as credit reserves Factor   had highly loaded with farmers working off farm in off seasons, farm activities diversification, family members working off farm activities and off farm investment

Result of factor analysis with mean values and factor loadings for the lower Mahanadi region is presented in table VI See Appendix   Four factors have been obtained and named as diversification, credit reserves, marketing and off farm activities   First factor named as diversification because it contained   variables which are related to diversification Second factor was summarised as credit reserves because it contains six credit risk management strategies Third factor was constructed as

marketing which contains four market risk management variables Factor four was named as off farm activities because it was having highly loaded off farm activities related variables

Determinants of Risk sources and management strategies

Multiple regression analysis was used to examine the relationship between socio economic variables, risk perceptions and management strategies Regression analysis showed the relationship between farmers characteristics and perceptions on various sources of risks credit, input cost, market risk, flood risk, production risk and cash lessness Bardhan *et al,* Ahsan, I bal *et al,* Asravor,

The result of this regression for upper, middle and lower regions are shown in table , and , respectively Further, table , and shows the relationship between risk management strategies and farm and farmers characteristics Patrick and Musser, Flaten *et al,* Bardhan *et al,* Ahsan,

Perceptions of risk sources

Upper region

Results demonstrate that aged farmers perceived credit, input cost, market, flood and production risk to be relatively higher for their farming, whereas younger farmers considered cash lessness to be an important source of risk Farmers belonging to ST and SC perceived credit, market and cash lessness risk as an important source of risk, whereas farmers belonging to General and OBC group considered input cost, flood and production risk as important Similarly, farmers with higher education considered credit and input cost as important sources of risk, whereas illiterate farmers perceived market and flood risk as major source of risk Table

Farmers who owned land considered input cost as the main source of risk, while landless farmers perceived credit and production risk as the major sources of risk Farmers who depend on other farm activities like dairy and fishery perceived production and cashlessness as major sources of risk Farmers with more earning members in the family considered input cost and flood risk as most important sources of risk On the other hand, cashlessness was perceived as a major source of risk by the farmers who had fewer earning members In this region, farmers mostly belonged to joint families Families with more earning members had greater household incomes because family members who were not engaged in farm activities opt for other off farm activities like daily wage labourers, construction workers and shop keeping ell trained and experienced farmers considered input cost and production risk as most important as compared to less experienced farmers Farmers who depend more on off farm income perceived credit risk to be important while farmers who do not depend on off farm income perceived input cost, flood and cashlessness risk as major sources of risk

Large farmers considered input cost as a major source of risk while small farmers identified credit, production and market risk as important sources of risk Input cost risk was perceived less by the farmers who received loans from banks Farmers who avail government support in the form of cash and kind perceived input cost, production and cashlessness risk to be less important Distance from the market had a positive impact on cashlessness risk Due to long distance of main market location, farmers of this region sold their product at lesser price This further led to input output imbalances

Farmers of this region perceived market risk to be relatively higher due to lack of information about the market shown in Table

Table 2: Determinants of Risk Perceptions of Upper Region Farmers

Socio-economic variables	Risk source factors					
	Credit	Input cost	Market	Flood	Production	Cash lessness
Farmer s age						
Social group						
ducation						
Land ownership status						
nterprise diversification						
Ratio of earning member to the household size						
xperience						
Off farm income						
Farm Size						
Market distance						
Market information						
Credit from bank						
Government supports						
Debt outstanding in bank						
R $_{Adj}$						
F statistics						

Note , ,   indicates the significance level at   ,   and   , respectively

Middle region

Results of the regression model table   indicates that aged farmers perceived production, land and cashlessness as important sources of risk Similarly, farmers belonging to ST and SC perceived production and credit risk as important On the other hand, risk of market and input cost was perceived as fre uent sources of risk for the General and OBC farmers This is due to the imbalance in distribution of land among different social groups Illiterate farmers perceived credit risk as the main factor of risk This may be because they were unaware of the rules and regulations of bank credit facilities Production, credit, land, input cost and cashlessness risks were perceived to be less risky by the farmers who have own land Farmers who live in joint families face more land risk than others This is because the earning members are more in number and the size of the land holding was relatively smaller Input cost was perceived as less risky by the farmers who depend more on other farm activities, like dairy   ouseholds having more earning members perceived cashlessness risk as less risky and land risk as high

xperienced farmers perceived production, input cost and cashlessness to be less risky, On the other hand, the less experienced farmer perceived credit, land and market risk to be high Similarly, farmers with more off farm income perceived production, input cost, cashlessness, market and land risk to be low Farmers with larger land size consider production and input cost risk as important, while the small land holders perceived credit and cashlessness risk as major sources of risk Input cost was perceived as a major source of risk for farmers who cannot avail bank loan Similarly, farmers with more outstanding loan in the bank perceived credit risk as most important Farmers who received more government support in terms of cash and kind perceived cashlessness as less risky than the other farmers Long distance of the main market from village has a positive relation with cashlessness and market risk Similarly, farmers with proper market information tend to have perceived input cost and market risk to be less risky

Table 3: Determinants of Risk Perceptions of Middle Region Farmers

Socio-economic variables	Risk source factors					
	Production	Credit	Input cost	Cashless	Market	Land risk
Farmer s age						
Social group						
ducation						
Land ownership status						
Other farm activities						
arning member to the household size						
xperience						
Off farm income						
Farm Size						
Credit from bank						
Outstanding loan						
Government subsidies						
Market distance						
Market information						
R $_{Adj}$						
F statistics						

Note ,   ,   indicates the significance level at   ,   and   , respectively

Lower region

Table   presents the result of multiple regression for the lower region The results were statistically significant at ,   and   per cent level It was clear from the table that age of the farmer had a negative impact on flood and land risk It means that as the farmer s age increases, the perceptions about flood and land risk reduces significantly Farmers belonging to ST and SC considered credit, input cost and land risk to be important sources of risk, whereas, general and OBC perceived flood and catastrophe to be riskier Credit, input cost and cashlessness risks were perceived to be less by the farmers who were engaged in other farm activities like dairy and poultry, whereas, land risk was perceived as riskier factor for them   ouseholds with more earning members perceived land risk as a very important source of risk, while market, flood, catastrophe and input cost risk were considered as less important Most farmers of this region also live in joint families   arning members also helped the farmer during farming period, which reduce the cost of cultivation They also engage in other activities, which stabilise the economic condition, and, further, it helps the farmer in risk reductions

         xperienced farmers tend to perceive market, flood and catastrophic risk as important Similarly, credit and land risks were perceived as less important for the farmers who have larger land holding Farmers with more off farm income perceived credit, input cost, flood, cashless and land risk to be less risky Farmers with larger farm size, perceived risks of market, flood and catastrophe to be most important in their farm business while the risk of credit, land and cashlessness are perceived as less important Farmers with more outstanding loan in the banks perceived credit risk to be more Similarly, farmers who received government support in terms of money or kind perceived cashlessness as less important Distance from main market had a positive impact on market and cashlessness risks Long distance of main market from villages increases the transportation cost as it reduces the income and increases cashlessness Farmers with proper market information perceived market risk to be lesser than other risks Level of education and bank loan are not significant in all the models

Table 4: Determinants of Risk Perceptions of Lower Region Farmers

Socio-economic variables	Risk source factors						
	Credit	Market	Flood	Input cost	Cashless	Catastrophe	Land risk
Farmer s age							
Social group							
ducation							
Land ownership status							
Other farm activities							
arning member to the household size							
xperience							
Off farm income							
Farm Size							
Credit from bank	nil						
Outstanding loan							
Government subsidies							
Market distance							
Market information							
R Adj							
F statistics							

Note , , indicates the significance level at , and , respectively

Overall results show that the factors like age, education, earning member to the household size, off farm income, farm size and government subsidies have a significant impact on farmers perceptions towards all risks in upper Mahanadi region Farmers from middle region reported social group, land ownership status, land size, off farm income and market information as the important determinants of risk perception Further, farmers from lower Mahanadi region considered social group, land ownership status, earning member to the household size, farm size and off farm income as the important factors which had a substantial effect on risk perceptions

Farmers Perceptions of Risk Management Strategies

Upper region

The results of multiple regression for the upper Mahanadi region is presented in table It can be clearly seen from the table that aged farmers from this region considered credit reserves and marketing as important strategies, whereas, off farm activities were considered as important strategy by the younger farmers Farmers belonging to SC and ST group perceived off farm activities as an important strategy because farmers from the SC and ST groups hold relatively smaller land size une ual distribution of land and credit reserves Conversely, farmers from General and OBC group perceived diversification, marketing and credit reserves as important management strategies due to their financial

stability Similarly, education has a significant relationship with diversification Farmers with higher education will be having more knowledge and understanding about the new technologies and seeds and this will encourage them to take higher diversification decisions for better production

Farmers with less owned land considered off farm activities as an essential mitigation strategy Diversification, keeping more credit reserves, marketing management and depending on off farm activities were the commonly followed management strategies of the farmers who had a greater number of earning members in their families More earning members in the family increases financial stability and it helps the farmers to adopt different new mitigation strategies Farmers with higher experience perceived diversification and marketing as essential management strategy, while less experienced farmers considered accumulating more credit reserves as important strategy

Table 5: Determinants of Risk Management of Upper Region Farmers

Socio-economic variables	Risk Management factors			
	Diversification	Credit Reserves	Marketing	Off-farm activities
Farmer s age				
Social group				
ducation				
Land ownership status				
Other farm activities				
Ratio earning member to family size				
Farming experience				
Off farm income				
Farm Size				
Credit from bank				
Outstanding loan				
Government subsidies				
Market distance				
Market information				
R $_{Adj}$				
F statistics				

Note   ,   ,   symbolize the significance at   ,   and

Farmers with more off farm income considered credit reserve, marketing and off farm investment as an important strategy Off farm income helped the farmer to increase credit reserves for future and to tackle market related risk like bearing transportation and storage cost Similarly, diversification was being perceived as an important management strategy for large land holding farmers, whereas credit reserves and off farm activities are essential mitigation strategies for marginal and small farmers Farmers with more outstanding loan in bank perceived off farm activities as

important management strategy Government support like lift irrigation facilities in the upper Mahanadi region has encouraged farmers towards higher diversification such as hybrid paddy seeds Further, this diversification helped the farmers to increase credit reserves Distance from the market has a negative relationship with marketing The farmers who were staying in distant villages from main market will tend to manage less market related risks The variables like other farm activities, bank loan and market information had an insignificant relationship with all the risk management factors

Middle region

Table   presents the results of multiple regression which shows the relationship between four risk management strategies and socio economic variables of middle Mahanadi region Aged farmers perceive diversification as an important mitigation strategy while younger farmer consider marketing and off farm activities as crucial strategies Similarly, diversification is considered as crucial mitigation strategy for the farmers belonging to the general and OBC category while SCs and STs consider credit reserves and off farm activities as important management strategies Farmers belonging to general and OBC categories are more educated and have more knowledge about farming than the other two categories This knowledge has helped them in diversification   ducated farmers perceived market risk as more important while illiterate farmers perceived credit reserves as more important Farmers who own land in their name are more likely to view diversification as an important management strategy while partial land holders considered credit reserves and off farm activities as important strategies of mitigation Diversification is perceived as less important by the dependant of other farm activities farmers Similarly, families with more earning members perceived diversification, credit reserves, marketing and off farm activities as the most important management strategies   xperienced farmers tend to perceive credit reserves, marketing to be significantly more important than other management strategies

Farmers with more off farm income are more likely to view diversification, credit reserves, marketing and off farm activities as essential management response Similarly, larger farmers considered diversification as more relevant while small farmers perceived credit reserve as more relevant management strategies Support from the government in terms of cash or kind have a significant positive impact on credit reserves of the farmers On the other hand, distance of the main market from village has a negative relation with risk management It implies that, as the distance of market increases the marketing management will become difficult for the farmers who stay in distant villages Farmers who have proper market information perceive credit reserve and marketing as relevant management strategies Bank loan and outstanding loan have insignificant relation with diversification, credit reserves, marketing and off farm activities

Table 6: Determinants of Risk Management of Middle Region Farmers

Socio-economic variables	Risk Management factors			
	Diversification	Credit Reserves	Marketing	Off-farm activities
Farmer s age				
Social group				
ducation				
Land ownership status				
Other farm activities				
arning member to family size				
xperience				
Off farm income				
Farm Size				
Credit from bank				
Outstanding loan				
Government supports				
Market distance				
Market information				
R_{Adj}				
F statistics				

Note , , indicates the significance level at , and , respectively

Lower region

Table shows the relation between four risk management factors and socio economic characteristics of lower Mahanadi region farmers Result of the study suggested that younger farmers of the Lower Mahanadi region tend to perceive marketing as an important management strategy SC and ST farmers considered off farm activities as significantly important while general and OBC farmers of this region considered credit reserves as most effective management strategy Similarly, farmers with higher education considered credit reserve as important management strategy On the other hand, diversification and credit reserves were the important management strategies followed by the farmers who had larger land holdings whereas partnership farmers perceived marketing and off farm activities as most important Farmers who engaged more on other farm activities, like dairy and fishery, perceived credit reserve as important source of risk, while diversification and marketing were less important Farmers with more earning members in family considered diversification, credit reserves, marketing and off farm activities as important management responses   xperience in farming had a significant positive relationship with marketing management strategy It indicates that market risk management strategies improve according to the years of experience of a farmer Farmers with more off farm income considered credit reserve and off farm activities as most important, while farmers with no off farm income considered diversification and marketing as the essential management strategies

Diversification was perceived as an important management strategy by large farmers and marketing was considered as important strategy by small farmers

Loan from the bank for farming during re uirements tends to help the farmer towards more diversification whereas more outstanding loan in bank reduces credit reserves and force them to engage more in off farm activities Support from the government, in terms of cash and kind, encourages the farmers towards more diversification, whereas, other farmers perceived off farm activities as most important coping strategy Long distance of village from main market will reduce the marketing management due to unavailability of proper transportation facilities Similarly, credit reserves and marketing were perceived as more relevant management strategies by the farmers who have proper market information

Table 7: Determinants of Risk Management of Lower Region Farmers

Socio-economic variables	Risk Management factors			
	Diversification	Credit reserves	Marketing	Off-farm activities
Farmer s age				
Social group				
ducation				
Land ownership status				
Other farm activities				
arning member to family size				
xperience				
Off farm income				
Farm Size				
Credit from bank				
Outstanding loan				
Government supports				
Market distance				
Market information				
R Adj				
F statistics				

Note   ,   ,   indicates the significance at   ,   and   , respectively

All the results from the three regions showed that the management strategies of the farmers in the upper region significant and highly affected by the socio economic factors such as social group, farm size ratio of earning member to the household size and off farm income In the case of middle Mahanadi region, it was highly affected by family size followed by off farm income and age   hile, management strategies of Lower region farmers were influenced by social group and land ownership status, other farm activities, earning member to the household size, farm size, outstanding loan and off

farm income Social category plays a vital role in upper, middle and lower region farmers decision making towards management strategies Similarly, off farm income also has a significant impact on management decision making in all the three regions

Conclusion

The results showed that the most important sources of risk were drought   for the upper Mahanadi region, inade uate government support including crop insurance   for the middle Mahanadi region and flood   for the lower Mahanadi region Important risk management strategies followed by the farmers were growing more than one variety of the same crop specifically paddy   for the upper Mahanadi region, growing more than one crop within the given land   for the middle Mahanadi and crop diversification   for the lower Mahanadi region

Farmers risk perceptions significantly affected by many socio economic variables in all the three regions The number of significant variables is high in lower and middle region than lower region In upper Mahanadi river region farmers were highly affected by age, education, earning member to the household size, off farm income, farm size and government support For middle region farmers, the important factors were social group, land ownership status, land size, off farm income and market information while for the lower Mahanadi region farmers it was social group, land ownership status, earning member to the household size, off farm income and farm size In addition, regression results showed that the variables like social group, ratio of earning member to the household size, off farm income and farm size had significant impact on the management strategies of upper Mahanadi region farmers In the middle Mahanadi region, the main management strategies were earning member to family size, off farm income and age The variables like social group and land ownership status, other farm activities, earning member to the household size, off farm income, farm size and outstanding loan were highly impacting management strategies of the lower region farmers

The results of this study indicate that irrespective of the regions, all the farmers in the sample were concerned about three important types of risk i e production risk, market risk and financial risks   owever, farmers risk perception varies significantly across the three study regions Therefore, the government policies and programmes should be implemented differently in these three regions The policy makers should frame policies according to the re uirements of farmers and by observing their perception toward risks Such policies and programmes will be beneficial for the farmers since it will encourage them in taking up more risks and make investments in agriculture without any constrain The findings of this study also indicate that the government should take more initiative to educate the farmers, inform them about available government schemes through advertisement and provide them with better training programmes Accessibility and affordability are still a concern among farmers in the context of credit Therefore, farmers should be provided with suitable credit facilities Better policies need to be framed that are more tenant friendly There is a lack of market facilities and road connectivity for farmers Therefore, such facilities should be provided to enable them to market their produce on time and directly without depending solely on intermediaries At present, the compensation for crop loss is reported to be inade uate Therefore, more compensation for crop loss should be

provided to the farmers The findings of the study not only provide valuable insight to the government but also to the researchers by highlighting the key issues that re uire attention

References

Ahsan, D A   Farmers Motivations, Risk Perceptions and Risk Management Strategies in a Developing conomy Bangladesh xperience *Journal of Risk Research*,

Akcaoz,   and B Ozkan   Determining Risk Sources and Strategies among Farmers of Contrasting Risk Awareness A Case Study for Cukurova Region of Turkey *Journal of Arid nvironments*,

Akhtar, S, L I Gu Cheng, R llah, A Nazir, M A I bal,   Raza and M Faisal   Factors Influencing ybrid Maize Farmers Risk Attitudes and their Perceptions in Punjab Province, Pakistan *Journal of Integrative Agriculture*,

Allais, M   The Foundations of the Theory of   tility and Risk Some Central Points of the Discussions at the Oslo Conference In *Progress in utility and risk theory* Springer, Dordrecht Pp

Amaefula, C, C A Okezie and R Mejeha   Risk Attitude and Insurance A Causal Analysis *American Journal of conomics*,

Asravor, R   Smallholder Farmers Risk Perceptions and Risk Management Responses   vidence from the Semi arid Region of Ghana *African Journal of conomic and Management Studies*,

Ayinde, O   ffect of Socio economic Factors on Risk Behaviour of Farming ouseholds An mpirical vidence of Small scale Crop Producers in Kwara State, Nigeria *Agricultural Journal*,

Bahinipati, C S and   Patnaik   The Damages from Climatic xtremes in India Do Disaster specific and Generic Adaptation Measures Matter   *nvironmental conomics and Policy Studies*,

Bahinipati, C S and L Venkatachalam   Determinants of Farm level Adaptation Practices to Climate xtremes A Case Study from Odisha, India India December ,

Bardhan, P,   P S Dabas, S K Tewari and K Avadhesh   An Assessment of Risk Attitude of Dairy Farmers in ttaranchal India International Association of Agricultural conomists, Annual Meeting, ueensland, Australia

Bishu, K G   Lahiff, O S Reilly and B Steiner   Cattle Farmers Perceptions of Risk and Risk Management Strategies   vidence from Northern thiopia *Journal of Risk Research*,

Chittibabu, P, S K Dube, J B Macnabb, T S Murty, A D Rao,   C Mohanty and P C Sinha   Mitigation of Flooding and Cyclone azard in Orissa, India *Natural azards*,

Dallas, M F   *Value and Risk Management A Guide to Best Practice* Oxford Blackwell Pub

Drollette, S A   *Managing Production Risk in Agriculture* Department of Applied conomics, tah State niversity

 llis, F   The Determinants of Rural Livelihood Diversification in Developing Countries *Journal of Agricultural conomics*,

Feder, G   *Farm Size, Risk Aversion and the Adoption of New Technology nder ncertainty* orld Bank

Flaten, O, G Lien, M Koesling, P S Valle and M bbesvik   Comparing Risk Perceptions and Risk Management in Organic and Conventional Dairy Farming   mpirical Results from Norway *Livestock Production Science*,

Government of Odisha   Annual Report on Natural Calamities Revenue Disaster Management Department, Special Relief Commissioner, Government of Odisha

                Annual Report on Natural Calamities, Revenue Disaster Management Department, Special Relief Commissioner, Government of Odisha

air, J F,   C Black, B J Babin and R Anderson   *Multivariate Data Analysis* Seventh dition, Prentice all, pper Saddle River, New Jersey

ardaker, J B ed   *Coping with Risk in Agriculture* Cabi

I bal, M A, Ping, M Abid, S M M Kazmi and M Rizwan   Assessing Risk Perceptions and Attitude among Cotton Farmers A Case of Punjab Province, Pakistan *International Journal of Disaster Risk Reduction*,

Kahneman, D, S P Slovic, P Slovic and A Tversky eds   *Judgment nder ncertainty euristics and Biases* Cambridge niversity Press

Kammar, S K and R Bhagat   Constraints xperienced by Farmers in Adopting Risk and ncertainty Management Strategies in Rainfed Agriculture *Pusa AgriScience*,

Kirchler, , B Maciejovsky and M eber   Framing ffects on Asset Markets An xperimental Analysis No , SFB Discussion Paper

Kumar, K A, A alia and S Chaturvedi   *India Disaster Report* National Institute of Disaster Management, IIPA Campus, New Delhi

Le Bihan, V, S Pardo and P G ILLotR A   Risk Perception and Risk Management Strategies of Oyster Farmers *Marine Resource conomics*,

Lucas, M P and I M Pabuayon   Risk Perceptions, Attitudes, and Influential Factors of Rainfed Lowland Rice Farmers in Ilocos Norte, Philippines *Asian Journal of Agriculture and Development*,

Maccrimmon, K and D A ehrung   *The Management of ncertainty Taking Risks* New ork

Murthy, M K K, B Dhananjaya and C M Naik   Organic Farming Practitioners and Their Perception *nvironment and cology*,

Neumann, J V and O Morgenstern   *Theory of Games and conomic Behavior* Princeton niversity Press, Princeton

Panneerselvam, P, N alberg, M Vaarst and J ermansen   Indian Farmers xperience with and Perceptions of Organic Farming *Renewable Agriculture and Food Systems*,

Patnaik, , P K Das and C S Bahinipati   Analyzing Vulnerability to Climatic Variability and xtremes in the Coastal Districts of Odisha, India *Review of Development and Change*,

                Coping with Climatic Shocks mpirical vidence from Rural Coastal Odisha, India *Global Business Review*,

Pennings, J M and A Smidts   Assessing the Construct Validity of Risk Attitude *Management science*,

Rabin, M and R Thaler   Anomalies Risk Aversion *Journal of conomic Perspectives*,

Ramaswami, R, S Ravi and S Chopra   Risk Management in Agriculture Discussion papers
,

Roy, B C, S S Mruthyunjaya and S Selvarajan   Vulnerability to Climate induced Natural Disasters
with Special mphasis on Coping Strategies of the Rural Poor in Coastal ORISSA, India In
NFCC COP Conference organized by the Government of India, N P and FICCI Vol

Sankar, and G Mythili   *ncertainty and Farm Production Decisions*

Sarkar, S and R N Padaria   Farmers Awareness and Risk Perception about Climate Change in
Coastal cosystem of est Bengal *Indian Research Journal of xtension ducation*,

Schoemaker, P J and J C ershey   tility Measurement Signal, Noise, and Bias *Organizational
Behavior and uman Decision Processes*,

Shapira, Z   Risk in Managerial Decision Making npublished manuscript, ebrew niversity,

Singh, C, A Rahman, A Srinivas and A Bazaz   Risks and Responses in Rural India Implications
for Local Climate Change Adaptation Action *Climate Risk Management*,

Sitkin, S B and A L Pablo   Reconceptualizing the Determinants of Risk Behavior *Academy of
Management Review*,

Stevens, J P   *Applied Multivariate Statistics for the Social Sciences* [nd] edition illsdale, NJ
 rlbaum

Van Raaij, F   conomic Psychology *J con Psychol*

Van insen, F, de Mey, L Lauwers, S Van Passel, M Vancauteren and auters   Determinants
of Risk Behaviour ffects of Perceived Risks and Risk Attitude on Farmer s Adoption of Risk
Management Strategies *Journal of Risk Research*,

 eber, and C see   Cross cultural Differences in Risk Perception, but Cross cultural
Similarities in Attitudes Towards Perceived Risk *Management science*,

 ehrung, D and K R Maccrimmon   *Taking Risks The Management of ncertainty* New ork
Macmillan

Appendix

Table I: Varimax Rotated Factor Loadings of Risk Source in Upper Mahanadi Region Farmers

Sources of Risk	Mean	Factor					
		Credit	Input cost	Market	Flood	Cash lessness	Production
Drought							
Shortage of cash on hand							
Lack of savings							
Inade uate government support including crop insurance							
Surface Runoff							
Pest and diseases							
ater logging							
Middlemen dominance							
Soil rosion							
nfavorable weather condition during crop cycle							
Sand casting							
Increase in labour cost							
Delay in access to institutional credit							
Lack of access to institutional credit							
Indebtedness							
Sediment loading							
Credit ceiling based on land							
navailability of Labour							
eeds							
Landlessness of family member within joint farm household							
Transportation problem							
Lack of availability of machinery and e uipment							
nexpected fall in the product prices							
nexpected rise in fuel prices for farm operations and transportation							
Varying institutional interest rates							
Change in land prices							
Lack of alternate markets							
Product uality re uirement of traders							
Per cent of total variance explained							
Cumulative per cent of the variance explained							

Note   Likert scale was used ranging from   not at all risky to   extremely risky

Table II: Varimax Rotated Factor Loadings of Risk Source in Middle Mahanadi Region Farmers

Sources of Risk	Mean	Factors					
		Production	Credit	Market	Input costs	Cash lessness	Land risk
Inade uate Government support including crop insurance							
Sand casting							
nexpected fall in the product prices							
Shortage of cash on hand							
Middlemen dominance							
ater Logging							
Drought							
Lack of savings							
Soil rosion							
nfavourable weather condition during crop cycle							
Product uality re uirement of traders of traders							
Surface Runoff							
Lack of alternate markets							
Pests and diseases							
Transportation problem							
Indebtedness							
eeds							
Change in labour cost							
navailability of Labour							
Sediment loading							
Credit ceiling based on land							
Lack of access to institutional credit							
Delay in access to institutional credit							
Landlessness of family member within joint farm household							
Varying institutional interest rates							
Lack of availability of machinery and e uipment							
nexpected rise in fuel prices for farm operations and transportation							
Changes in land prices							
Per cent of total variance explained							
Cumulative per cent of the variance explained							

Note Likert scale was used ranging from not at all risky to extremely risky

Table III: Varimax Rotated Factor Loadings of Risk Source in Lower Mahanadi Region Farmers

Sources of Risk	Mean	Factors						
		Credit	Market	Flood	Input cost	Cash lessness	Cata strophe	Land risk
ater Logging								
Inade uate Govt support including crop insurance								
Shortage of cash on hand								
eeds								
nexpected fall in the product prices								
Lack of savings								
Drought								
Middlemen dominance								
Pest and diseases								
nfavourable weather condition during crop cycle								
Sand casting								
Lack of access to institutional credit								
navailability of Labour								
Product uality re uirement of traders of traders								
Lack of alternate markets								
Indebtedness								
Change in labour cost								
Credit ceiling based on land								
Delay in access to institutional credit								
Landlessness of family member within joint farm household								
Transportation problem								
Surface Runoff								
Changes in land prices								
Soil rosion								
Lack of availability of machinery and e uipment								
nexpected rise in fuel prices for farm operations and transportation								
Sediment loading								
Varying institutional interest rates								
Per cent of total variance explained								
Cumulative per cent of the variance explained								

Note Likert scale was used ranging from not at all risky to extremely risky

Table IV: Varimax Rotated Factor Loadings of Risk Management Strategies in Upper Mahanadi Region Farmers

Risk management strategies	Mean	Factors			
		Diversification	Credit reserve	Marketing	Off-farm activities
Growing more than one variety of the same crop s					
Lift borewell irrigation					
Re cultivation of seedlings					
sing traditional flood resistance crop					
Arrangement of money from friends and relatives					
Pests and diseases control					
iring labour on need basis					
Crop diversification					
Farmers working off farm in off seasons					
Cultivating in Rabi and Summer season instead of Kharif					
Depending on Precautionary Saving					
Family members working off farm activities					
Gathering market information on price forecasts and trends					
Leasing assets rather than owning them					
Depending on MGNR GA					
Management of debt					
Spreading sales over time by storing product					
Growing more than one crop					
Off farm investment					
nterprise diversification apiculture, poultry and animal husbandry					
Spreading sales among retailers					
Dependent on government financial support					
Selection of crop varieties with low output price variability					
Per cent of total variance explained					
Cumulative per cent of the variance explained					

Note   Likert type scale was used   not at all important to   extremely important

Table V: Varimax Rotated Factor Loadings of Risk Management Strategies in Middle Mahanadi Region Farmers

Risk management strategies	Mean	Factors			
		Diversification	Marketing	Credit reserves	Off-farm activities
Growing more than one crop					
Depending on Precautionary Saving					
Arrangement of money from friends and relatives					
Cultivating in rabi and Summer season instead of Kharif					
Farmers working off farm in off seasons					
Depends on government financial support					
Farm activities diversification apiculture, poultry and animal husbandry					
Spreading sales over time by storing product					
Gathering market information, such as price forecasts and trends					
ired labour, in case of need					
Growing more than one variety					
Application of monitoring and programmes for pests and diseases					
Leasing assets rather than owning them					
Depending on MGNR GA					
Management of debt					
sing traditional flood resistance crop					
Family members working off farm activities					
Farm crops diversification					
Spreading sales among retailers					
Selection of crop varieties with low price variability					
Off farm investment					
Recultivation of seedlings					
Lift borewell irrigation					
Per cent of total variance explained					
Cumulative per cent of the variance explained					

Note   Likert type scale was used   not at all important to   extremely important

For maintaining smooth path of consumption and avoiding adverse effects of future income fluctuation, farmers keep some amount from their current income as precautionary reserves by consuming less in the current period called precautionary savings

Table VI: Varimax Rotated Factor Loadings of Risk Management Strategies in Lower Mahanadi Region Farmers

Risk management strategies	Mean	Factors			
		Diversification	Credit reserves	Marketing	Off-farm activities
Farm crops diversification					
Cultivating in rabi and summer season instead of Kharif					
Growing more than one crop					
Application of monitoring and programmes for pest and diseases					
ired labour, in case of need					
Arrangement of money from friends and relatives					
Gathering market information, such as price forecasts and trends					
Depending on Precautionary Saving					
Growing more than one variety					
Leasing assets rather than owning them					
Family members working off farm					
Management of debt					
Spreading sales over time by storing product					
sing traditional flood resistance crop					
Spreading sales among retailers					
depend on MGNR GA					
Farmers working off farm in off seasons					
off farm investment					
Selection of crop varieties with low price variability					
Lift borewell irrigation					
Recultivation seedling					
Farm activities diversification apiculture, poultry and animal husbandry					
Depends on government financial support					
Per cent of total variance explained					
Cumulative per cent of the variance explained					

Note Likert type scale was used   not at all important to   extremely important

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