FINANCIAL RISK MANAGEMENT IN DRY-LANDS OF PRAKASAM DISTRICT OF ANDHRA PRADESH

Dr.K. Kishore Kumar

Asst.Professor in Management, IIIT Idipulapaya, Kadapa, AP-516330, India.

Abstract

Agricultural production in a country like India involves variety of risk this risk arise from climate variability frequent natural disasters, Insolvency, manmade disaster, rural infrastructure pest out breaks accidental factors, lending money can also be risky with sudden changes in interest lead to failure of business, risk also occurs as a result of changes in government policies, finally there are risks related to the health and well being of the farmer and his family and the supply of labour for the farm, all these event together or independently affect farmers through loss in production and farm income and they are beyond the control of the farmers, these factors not just endanger the farmer's livelihood and income but also undermine the viability of the agriculture sector and its potential to become a part of the solution to the problem of endemic poverty of the farmer's and the agricultural labor.

Risk reducing strategies are often used in combination with one another, as no single strategy can cover all of the risk likely to be encountered, farmer's need to consider the risks simultaneously and to develop an integrated approach for better management of farm business. Agricultural producers should not limit their risk management strategies only to lessening and offsetting the problems caused by weather and climatic events. Their effective responses to the diver's professional, economic and political challenges are also increasingly crucial to successful farming.

Key Words: Poverty Trap, Disasters, Insolvency

Introduction:

Risk is one of the factors affecting agriculture producer directly or indirectly, risk c in the absence of effective mechanism for protection against risk has several adverse implications for stability of farm production, farm income, and livelihood, investment in farming and application and adoption of advanced technology. In the recent times the farmer's suicides are continuous, because of agriculture distress. This underscores the need for effective risk management strategies in agriculture.

Decision –making is different as it depend very often imperfect information[1]

This inability to manage risk and accumulate and retain wealth is sometimes referred to as the "The Poverty Trap".

Are there any factors that mitigate the consequences of the risk or that reduce the probability of risk?[1]

The ICRISAT village studies collected information on household income and consumption. Recall that out of the sample of 40 households in each village, 30 households were cultivator households and 10 were landless labour households. Hence the major components of household income were crop revenue and labour income[2] (Walker and Ryan, 1990)

Over long period of time, many agriculture production cycles stretch, and farmers must anticipate expenses that they will only be able to recuperate once the product is marketed, this casus potential cash flow problems exacerbated by lack of access to insurance services, the high cost of borrowing and credit. This problem is classified as financial risk[3]. Agricultural Assets and Liabilities, Assets or resources include all items of property having a money value which are the legal possessions of a person or farm. Usual assets of a farmer include the farm land, buildings, equipment and machinery, livestock, accounts and notes receivable, feeds, cash in hand, supplies on hand and other personal belongings.

According to Naik and Jain (2002), liquidity is a major problem in all futures markets except those of castor seed and pepper[4].

Risk Management Strategies

World Bank (2001) highlighted in world development report, difference between on-farm strategies and rise-sharing strategies[5]. Ex ante informal strategies are characterized by diversification of income sources and choice of agricultural production strategy. Once strategy producers can employ is simply to avoid risk. In many cases, extreme poverty makes people very risk averse. After avoiding activities that entail rise but that could also bring larger income gains.

Risk Attitude and Perception

According to Binswanger (1980), who conducted experiments with individuals in rural India with real monetary payoffs, 300 individuals were randomly picked from the six villages that formed the field subjects for the ICRISAT study. In his experiment, Binswanger offered the subjects the choice of lotteries with different payoffs. From the choices made by the subjects, it is possible to infer their risk aversion. From analyzing the pattern of such choices, Binswanger found that most farmers in the ICRISAT villages were intermediate to moderately risk averse[6].

Research Gap:

Study by Binswanger (1980), Lipton and Longhurst (1989) and (Walker and Ryan (1990) focused on behavior studies in Indian agriculture that is on decision making of farmers and attitude of farmers, Planning commission (2007) of India outlined risk management in agriculture, report highlighted different types of risks and risk management strategies. To study focuses on financial risk management in agriculture in Indian context.

Objectives of the Study

The main objective of the study is to provide basis for debate by surveying literature and analyzing risk related data and make suggestions for the decision makers of Indian agriculture for discussing possible future Indian risk management strategy in agriculture. Beside the general purpose of the research, the main objectives of dissertation are summarized as following.

Objectives

1. To examine financial risk and risk management strategies in Prakasam district of Andhra pradesh.
2. To survey the financial risk and risk management strategies available and applied in farming.
3. To analyze financial risk management in Indian agriculture and to improve with suggestions and conclusions.

Q.1)   What are the causes and Consequences of financial crisis in Prakasam district agriculture adequacy of tools and methods?

Content of the Schedule:
The study analyzes risk and risk management in the district dry land farming at disaggregates level. The district has different farming groups and it is one of the few. It is one of the drought prone districts of the state of Andhra Pradesh. It has the lowest rainfall of 871.5 mm with a lot of variability across space and time. Less than 30 percent of the cropped area only has irrigation facilities, sources of irrigation are dependent on rainfall and, hence are not dependable, aquaculture enterprise was hit by diseases and they are under it declined. The district was the first one in the country to be known for suicides by farmers on account of crop failure, many farmers are diversifying their lands for social forestry due to non-viability of annual crops; Ongole breed cattle are on the decline because of the inability of the farmers to maintain them. All these weaknesses make farming in the District high risk and low income activity. There are various factors affecting farming activity in the District which include low rainfall ad predominance of light soils; thus agricultural enterprises are becoming more risky. There are various steps taken by the state government for increasing water use efficiency, supporting Farmer's Field Schools (FFS) and strengthening extension support by appointing agricultural officers, technology facilitators and model farmers, development of human resource through training etc. Beside government strategies there are other strategies like crop diversification which are popular in the district to deal with risk.

Sample Size:
There is no relevant data available on the topic, primary data collected among the farmers of prakasam district of Andhra Pradesh. Total of 504 farmers are selected for the purpose of the study.

Sample Design
Survey planed in prakasam district of Andhra Pradesh to collect primary data. Stratified sampling method is used for the survey; the point of this method is to divide the heterogeneous population into homogenous subgroups, so called strata. Strata are mutually exclusive, so every element in the population must be assigned to only one stratum. The elements of the sample are randomly selected from each stratum, the main characteristic of the proportional allocation is that it uses a sampling fraction in each of the strata that is proportional to that of one's found in population the

sample can be considered representation which makes it possible to examine the features of the population on a relatively small sample.

Sampling Process

Previous Prakasam District is divided into 56,mandals and 1043 gram panchayats, since the gram panchayat is too small a unit to be considered as a planning and monitoring unit, the next unit in hierarchy i.e. mandal has been considered as the planning unit for various agricultural and allied activities. Total of six hundred and seventy two farmers participated in the survey to provide information.

According to Prakasam District Administration, the district is divided into three revenue divisions Ongole, Kandukur and Markapuram. There are twenty mandals under Ongole Division, Twenty FourMandals under Kandukur Division and Twelve Mandals under Markapuram Division. Gram Panchayats in Andhra Pradesh are divided into two categories known as notified Gram Panchayats and non-notified Gram Panchayats. The total number of Gram Panchayats in the district is 1043 out of which 62 are notified and 981 are not notified. Gram Panchayat is one whose Revenue is more than Rs. 60,000/- per annum, a non-notified Gram Panchayat is one whose revenue is below Rs. 60,000/- Chimakurthi Mandal is famous for granites with exports to various parts of the world, mining is the main source of income in the mandal, mining is also extended to Marturmandal. Chinaganjammandal is famous for Aqua Cultivation due to back water available for the purpose, thus aqua cultivation is main source in the mandal, as mining and aqua cultivation is main source of income in these mandals the three mandals are not much involved in agriculture. Our present study focused on farming on crop and live stock, as both cannot be separated, thus the three mandalsChimakurthi, Chinaganjam and Martur are excluded from the study. Thus out of 62 notified Gram Panchayats, one from Martur, three from Chinaganjam and two from Chimakurthi are excluded from the study, 56 notified Gram Panchayats are selected for sample execution.

Data Analysis:
Statistical tests used:

The Chi-Square test of Independence is used to determine if there is a significant relationship between two nominal (categorical) variables. The frequency of one nominal variable is compared with different values of the second nominal variable.

Hypothesis testing: It is the same for the Chi-Square test of Independence as it is for other tests like ANOVA, t-test, etc. If the calculated value of the Chi-Square test is greater than the table value, we will reject the null hypothesis. If the calculated value is less, then we will accept the null hypothesis.

Financial Risk
Financial-risk influences the profitability and also leads to failure of the business.
Consequences of Financial Risk

Financial risks can lead to reduced profitability in farming operations. Fluctuating market prices, high input costs, yield losses due to weather events or pests, and inadequate access to credit can erode farmers' income and profitability.

Table – 1Degree of concern on consequences of financial risk in the district

S.No.	Consequence of Financial Risk	Diversified Farming Contribution in Overall Average	Non-Diversified Farming Contribution in Overall Average
1	Insolvency	4.37 (large effective)	4.62 (large effective)
2	No Credits	3.06 (moderate effective)	4.18 (large effective)
3	Loosing Job	2.97 (Negligible effective)	2.43 (Negligible effective)
4	Equity Loss	2.16 (Negligible effective)	2.73 (Negligible effective)

Category * TypeOfFarming Crosstabulation

Count

| | | TypeOfFarming | | |
		Diversified Farming	Non-Diversified Farming	Total
Category	1	4	5	9
	2	3	4	7
	3	3	2	5
	4	2	3	5
Total		12	14	26

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.503[a]	3	**.918**
Likelihood Ratio	.503	3	.918
Linear-by-Linear Association	.006	1	.937
N of Valid Cases	26		

a. 8 cells (100.0%) have expected count less than 5. The minimum expected count is 2.31.

Inference: **Consequence of Financial Risk** are not dependent on the type of the farming.

ANOVA

Tests of Between-Subjects Effects

Dependent Variable: Number

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.426[a]	4	1.357	5.660	.093
Intercept	87.715	1	87.715	365.968	.000
category	5.171	3	1.724	7.191	**.070**
TypeOfFarming	.256	1	.256	1.066	**.378**
Error	.719	3	.240		
Total	93.860	8			
Corrected Total	6.145	7			

a. R Squared = .883 (Adjusted R Squared = .727)

Post Hoc Tests
Category
Homogeneous Subsets

Number

Duncan[a,b]

Catogory	N	Subset	
		1	2
4	2	2.4450	
3	2	2.7000	
2	2	3.6200	3.6200
1	2		4.4800
Sig.		.096	.177

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = .240.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = 0.05.

Inference: There is no significant difference among the categories.

"Insolvency" is most effective.

There is no significant difference between Diversified Farming and Non- Diversified Farming types.

H_0 isaccepted

H_1 is accepted

Correlation:

	Diversified Farming	Non-Diversified Farming
Diversified Farming	1	
Non-Diversified Farming	0.767398	1

Inference: High correlation is observed between the farming types.

Interpretation

　　　Scarcity of capital is a serious problem on most of the Indian farms. Now farming is becoming more capital intensive as the now technology demands more investment on improved seeds. Fertilizers, plant protection measures, irrigation, equipmentsetc, therefore, access to credit, availability and debt play on important role on farming.

It is asked in the schedule to evaluate degree of concern on consequences of financial risk. Respondents had the possibility to rate each consequence on a scale of 1-7 where it means that the given consequence has no effect on farmer while in case of 7 the consequence has great effect on farmer and his farming activity.

It is observed in the study consequence of financial risk are not dependent on the type of farming. In solvency is the consequence considered by the farmers as huge affect, financial factors are affecting farmer's at large extent.

Farmer's Debit Exist at the Present Moment

Farmers may incur debt for various reasons in operating their farm business.

Table -2
Farmers debit exist towards banks or other agencies at present moment

S. No.	Farmers debit exist towards banks	Diversified Farming		Non-Diversified Farming	
		No. of Respondents	Contribution in Percentage (%)	No. of Respondents	Contribution in Percentage (%)
1.	YES	118	72.83%	205	62.88%
2.	NO	44	27.16%	121	37.11%
3.	Total	162	100	326	100

Catogory * TypeOfFarming Crosstabulation

Count

		TypeOfFarming		
		Diversified Farming	Non-Diversified Farming	Total
Catogory	1	118	205	323
	2	44	121	165
Total		162	326	488

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.793[a]	1	**.029**		
Continuity Correction[b]	4.359	1	.037		
Likelihood Ratio	4.890	1	.027		
Fisher's Exact Test				.033	.018
Linear-by-Linear Association	4.784	1	.029		
N of Valid Cases	488				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 54.77.

b. Computed only for a 2x2 table

Inference: **Farmers debit exist towards banks**is dependent on the type of the farming.

ANOVA

Tests of Between-Subjects Effects

Dependent Variable:Number

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12965.000[a]	2	6482.500	259.300	.044
Intercept	59536.000	1	59536.000	2381.440	.013
Catogory	6241.000	1	6241.000	249.640	**.040**
TypeOfFarming	6724.000	1	6724.000	268.960	**.039**
Error	25.000	1	25.000		
Total	72526.000	4			
Corrected Total	12990.000	3			

a. R Squared = .998 (Adjusted R Squared = .994)

Inference: There is a significant difference among the categories.

There is a significant difference between Diversified Farming and Non- Diversified Farming types.

H_0 isrejected

H_1 is rejected

Correlation:

	Diversified Farming	Non-Diversified Farming
Diversified Farming	1	
Non-Diversified Farming	1	1

Inference: Perfect correlation is observed between the farming types.

Interpretation

Special institutions, agricultural banks are functioning in India to provide credit for farmers which insulate them from both credit supply and risk management issues to some extent. With this assumption, it is asked in the research schedule, farmer's source of finance and his status of debit at present moment.

It is observed in the study farmers debit exist towards banks is dependent on the type of the farming. There is a significant difference between diversified and non-diversified farming. Perfect correlation is observed. Farmers of diversified farming are capable of getting access to credit more easily than that of non-diversified farming. It is found for one crop the crop loan amount is one lakh for other type is "between" 40 to 60 thousand. Diversified farmer is making advantage of high loan crop as one out of three crops or income sources this type of strategy is applied in diversified farming.

Farmers Source of Finance

Farmers rely on various sources of finance to fund their agricultural operations.

Table 3 -Source of finance among the farmers of the district

S.No	Source of finance	Diversified Farming		Non-Diversified Farming	
		No. of Respondents	Contribution in (%)	No. of Respondents	Contribution in (%)
1	Self Financing	35	21.60%	78	23.92%
2	Institutional Sources	119	73.45%	67	20.55%
3	Relatives	27	16.67%	62	19.01%
4	Friends	22	13.58%	50	5.33%
5	Money Lenders	8	4.93%	48	14.72%
6	Other Sources	30	18.51%	61	18.71%
7	Total	162	100	326	100

Catogory * Type Of Farming Crosstabulation

Count

		TypeOfFarming		
		Diversified Farming	Non-Diversified Farming	Total
Catogory	1	35	78	113
	2	119	67	186
	3	27	62	89
	4	22	50	72
	5	8	48	56
	6	30	61	91
Total		241	366	607

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	71.997[a]	5	**.000**
Likelihood Ratio	73.388	5	.000
Linear-by-Linear Association	14.825	1	.000
N of Valid Cases	607		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 22.23.

Inference: **Source of finance** is related to the type of the farming.

ANOVA

Tests of Between-Subjects Effects

Dependent Variable:Number

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	6541.500[a]	6	1090.250	1.672	.295
Intercept	30704.083	1	30704.083	47.101	.001
Catogory	5239.417	5	1047.883	1.607	**.308**
TypeOfFarming	1302.083	1	1302.083	1.997	**.217**
Error	3259.417	5	651.883		
Total	40505.000	12			
Corrected Total	9800.917	11			

a. R Squared = .667 (Adjusted R Squared = .268)

Post Hoc Tests

category

Homogeneous Subsets

Inference: There is no significant difference among the categories.

There is no significant difference between Diversified Farming and Non- Diversified Farming types.

H_0 **is accepted**

H_1 **is accepted**

Correlation:

	Diversified Farming	Non-Diversified Farming
Diversified Farming	1	
Non-Diversified Farming	0.449266	1

Inference: Low correlation is observed between the farming types.

It is observed in the study majority of the farmers are not able to self-finance their farming activity, farming is a seasonal activity it is a biological activity need long course of time compared with other manufacturing industry. All the penetration of institutional source of finance is demand. Despite of any type of farming taken in the study there is huge need of finance is expected by the farmers of the district.

Farmers Perception of Access to Credit:

Farmer's perception of access to credit can vary based on their individual experiences and the specific context in which they operate.

Table –4

Farmer's perception of access to credit among the farmers of the district

S. No	perception of access to credit	Diversified Farming		Non-Diversified Farming	
		No of farmers	Contribution in percentage %	No of farmers	Contribution in percentage %
1.	There is no access to credit at all	35	21.60%	189	57.97%
2.	Cost and conditions are reasonable but require long procedure	12	7.40%	79	24.23%

3.	There is timely access but with reasonable cost and conditions	98	60.49%	46	14.11%
4.	There is timely access but with hard conditions and high cost	17	10.49%	12	3.68%
5.	Total	162	100	326	100

category * TypeOfFarming Crosstabulation

Count

		TypeOfFarming		Total
		Diversified Farming	Non-Diversified Farming	
category	1	35	189	224
	2	12	79	91
	3	98	46	144
	4	17	12	29
Total		162	326	488

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	134.974[a]	3	**.000**
Likelihood Ratio	135.427	3	.000
Linear-by-Linear Association	101.358	1	.000
N of Valid Cases	488		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.63.

Inference: **perception of access to credit** is related to the type of the farming.

ANOVA

Tests of Between-Subjects Effects

Dependent Variable:Number

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13611.000[a]	4	3402.750	.843	.579
Intercept	29768.000	1	29768.000	7.377	.073
category	10249.000	3	3416.333	.847	**.553**
TypeOfFarming	3362.000	1	3362.000	.833	**.429**
Error	12105.000	3	4035.000		
Total	55484.000	8			
Corrected Total	25716.000	7			

a. R Squared = .529 (Adjusted R Squared = -.098)

Post Hoc Tests
category
Homogeneous Subsets
Number

Duncan[a,b]

Catogory	N	Subset
		1
4	2	14.5000
2	2	45.5000
3	2	72.0000
1	2	112.0000
Sig.		.215

Means for groups in homogeneous subsets are displayed.
 Based on observed means.
 The error term is Mean Square(Error) = 4035.000.

a. Uses Harmonic Mean Sample Size = 2.000.

b. Alpha = 0.05.

Inference: There is no significant difference among the categories.
There is no significant difference between Diversified Farming and Non- Diversified Farming types.
H$_0$ isaccepted

H$_1$ is accepted

Correlation:

	Diversified Farming	Non-Diversified Farming
Diversified Farming	1	
Non-Diversified Farming	-0.10187	1

Inference: Very low negative correlation is observed between the farming types.

Interpretation

Beside it is also asked about farmer's perception of access to credit, farmers opinion on access to credit, there is no access to credit at all.

It is observed in the study perception of access to credit is related to type of farming, 60.49% of diversified farmers believe there is timely access but with reasonable cost and conditions, 57.97% of non-diversified farmers believe there is no access to credit at all. Diversified farmers are in best management practices compared with non-diversified farmers.

Farmers often do not have enough capital to invest in their farm businesses, they mainly depend on banking system and risk is caused by access to credit, fluctuating interest rates and managing their financial resources. This type of risk has three overall dimensions; they are interest rate changes, liquidity and solvency.

It is observed little attention has been given to small business entities, special agricultural banks were set up in India to provide credit to farmers which insulated them from both credit supply and risk management issues to some extent but farmers are over loaded with financial burden.

The objective of risk management in agriculture is to reduce the chances of a vulnerable situation occurring, on other hand, maximizing returns to owner's equity consistent with farmer's attitudes to risk. Factors that can influence farmers decision include the farmer's attitude; the costs involved in risk sharing, the relative size of potential loss and probability of it occurring, the correlation of the risk with other risks, other sources of indemnity; the farmer's perception of the nature of risk and the farmer's financial state. Many farmers diversity their production, preferring the lower, more stable income from a diversified set of enterprises to the higher; more variable income generally associated with specialization in a single enterprise. They face uncertainty about the

economic consequences of their actions due to their limited ability to predict things such weather, prices and biological responses to different farming practices. It is generally assumed that farmers are risk-averse; i.e., they are willing to pay a premium to reduce exposure to risk. Little attention has been given to investigating farm finance and financial risk in farming; even though this sector is still important in developing economy. Financial risk can be viewed in three dimensions Interest rate change, Liquidity and Solvency.Suicides of farmers as an indication of our failure, to manage risks in agriculture the study is an important step towards strengthening risk management in Indian agriculture. The agrarian distress without late is assuming lot of significance and should be handled urgently. Study indicates that except for enhanced credit, other variables have not grown proportionately.Falling rate of capital formation in agriculture, low and fluctuating levels in crop productivity, inadequate irrigation facilities, degradation of natural resources, skewed agricultural price support policies needed corrective action. The return in cash is mostly once in a year for farmer, If there is a good crop, the farmer's are getting more return otherwise not, it means, the return from agricultural produced is irregular and high risk.All farm operations in the District are seasonal in nature, by devoting some time on the farm, farmer's are taking up and expanding other non-farm occupations and thus earn higher total family income. This type of practice is observed to avoid risk. There are various factors affecting farming activity these factors mainly include debt, weather and natural disaster, delay in monsoon and effect of climate change and volatility of price and input market. This factors causing low yield, low income, loss of income, loss of revenue and threatening the livelihood of the farmer.Majority of the farmers income lie in between 25 to 30 thousand, this describes the income level very low in farming. Income of the farm is dependent on the type of farming which have an impact on livelihood.Various factors affecting farming activity, farmers are just accepting risk in many cases but diversified farmers are willing to take risk and accept loss in production. In case of non-diversified farmers, they are unable to deal with risk and avoiding risk.

Technology to improve Performance of Assets:

Satellite can be developed to measure the moisture level, crop health and performance of assets etc, by applying image processing. Geo Information System (GIS) this technology provides geospatial data to create maps and visualize the location and condition of various agriculture and irrigation related data. Remote sensing technology helps to monitor and review the agri business. AI can be used to analyze large agriculture and related data to provide insights to improve decision making in agriculture. GPS – guides tractors and drones, can be used for optimization in farm operations, interne ting of things improves the performance of agri- business.

Modern agriculture is trending with internet ting of various assets in agriculture these assets include, farm land, farm in-puts, hiring services, source of information, mobile apps, Irrigation system, data is developed through sensors this data is processed and sent to Smartphone. Modernization of agriculture shaped in such a way. Internet ting of things provides two types of data, macro level and micro level data. For sustainability and optimization of resource we are not over exploiting the natural resource, when we are irrigating, if we are irrigating based on the sensor

records, sensor records and also some model output. in that case we are doing the irrigation management and that is optimum natural resource management, we are reducing the wastage of the irrigation water, then we are conserving the ecosystem, then we are doing the adequate service deployment and finally, we are using modern technologies for achieving these goals.

The information and communication technology or ICT, which is a very common word nowadays, they are especially in the agriculture sector; this ICT application in agriculture has different components. For example, farm management information system is an important component, then humidity and soil sensors are very important component and then accelerometers, then wireless sensor networks. then cameras for taking the images, then drones also for taking the images, the low cost satellites, online services and automated guided vehicles all these are part of the information and communication technology. Nowadays, automated guided vehicles have been used with machine vision for performing different types of field operation like weeding, like harvesting also, online services are there to provide the required information to the farmers doorstep, also there are some local service satellites, drones are being utilized for spraying and other operations and also to take the images for better image processing and management decisions. Cameras are being used for taking the images and developing the image based algorithms, wireless sensor networks are being used for IoT or internet of things. You can see that a multitude of elements are there in the ICT especially when we talk about agriculture.

Interne ting of things improve the efficiency of the farming activity, Block chain technology secure and track ownership transaction of assets, include, crop livestock equipment etc. Which avidest risk of fraudulent activities and improve transparency in transportation of goods which improves supply chain efficiency.

Predictive analytics can be use to predict future by analyzing the past data in agriculture to support decision making.

Crop modeling helps farmer to optimize farm business operations and take informative decisions by using computers and simulations.

Mathematical Models: Data driven agriculture is done by applying different models in agriculture these models helps farmer to understand the source of finance performance of farm business and improve his financial decision by adjusting to improve financial performance. Phasing of investment, understanding the financial performance, liquidity management other financial decisions can be improved by applying models to financial optimization in agriculture.

a) DSSAT – Decision Support system for agro technology Transfer.

b) APSM – Agriculture Production Systems Simulator

c) Crop Syst - used for different environment and management conditions.

d) Aqua crop

e) SALUS – System Approach to Land Use Sustainability

Optimal solutions in agriculture improve effective, use of natural resource with sustainable practices and reduce the cost of operations. Farming involves various activities, selling to a potential buyer by taking produced to a right market place at right time, perchance of inputs with trust and experience cost quality and availability of inputs play an important role, managing of

farm resource which include nutrition of the soil, pest management, irrigation management etc., not just managing, it is also crucial to sustain resource in the era of sustainable agriculture, as farming activities are generally performing in open environment compared with other industries, prediction of weather stress a critical factor for agriculture production, managing assets and risk is another important factors taken into consideration. By optimizing operations, proper risk management strategy and sustaining the resource improve production and productivity in agriculture. Data is equal to goal, data mining is compared with mining of gold, data driven agriculture improves accuracy in agriculture-decision making. Use of sensor creation of data drawing insights from farm business activities improves business operations in agriculture.

References

1. Kalirajan K. and Huysman, A.,1984 an economic analysis of production risk using farm level panel data the Philippines Indian journal of agriculture economics 3 9(4)614-629.
2. Walker, T.S., and Ryan, J.G. (1990). Village and Household Economies in India's Semiarid Tropics. Baltimore: Johns Hopkins University Press.
3. Planning commission 2007 report of working group on risk management of agriculture XI five year plan.
4. Naik, G. and S. K. Jain (2002). Indian Agricultural Commodity Futures Market: A Performance Survey, Economic & Political Weekly, 37: 3161-3173.
5. Planning commission 2007 report of working group on risk management of agriculture XI five year plan.
6. Binswanger, H. P. (1980). Attitudes towards Risk: Experimental Measurement in Rural India. American Journal of Agricultural Economics 62(3): 395-407.