Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 6, Issue 05, May -2019

IDENTIFICATION OF RISK INVOLVED AND RISK MANAGEMENT IN GROWTH OF POTATO AND GINGER IN HIMACHAL PRADESH

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ABSTRACT- *Agricultural risks are aggravating in Himachal Pradesh due to a variety of factors, ranging from a shortage of required inputs, weather and climatic conditions, lack of support from government and various government bodies, inadequate income generation, a shift in consumer preferences, and lack of technical know- how. These factors endanger the livelihood of small farmers and also affect the economic development of Himachal Pradesh economy. The current study has been undertaken with the objective of identification of agricultural risk and risk management strategies and tools. The study includes 360 farmers from Shimla, Sirmaur and Solan districts of the state who are engaged in the cultivation of potato and ginger both. In the study, agricultural risks are identified as problems by the respondents engaged in the production of ginger and potato; factor analysis is done to identify significant risks associated with the growth of potato and ginger. Efficient risk management leads to a reduction of losses caused by risk as well as increase the profitability, leading to the development and growth of cash crops, namely Potato and Ginger in Himachal Pradesh. Paper tries to discuss the formal and informal strategies farmer can undergo to combat risk in the cultivation of ginger and potato in Himachal Pradesh.*

Keywords- *Agriculture, Growth, Risk, Potato, Ginger, Factor analysis, Risk Management.*

I. INTRODUCTION

The Agriculture in Himachal Pradesh is subject to numerous uncertainties. As agriculture is the largest source of employment and livelihood for the population in Himachal Pradesh, contributing to 17 per cent of GDP and employs almost 69 per cent of the population. In the past growth of agriculture was driven by the change in agricultural pattern, directly affecting output and farm income. Things are entirely different today, with the tremendous increase in the cost of living over the last few decades, it is difficult to make ends meet with the cultivation of traditional crops; this is the main driving force which made commercial crops overtake traditional crops. Despite being traditional crops, Potato and Ginger made it to the list of cash crops in Himachal Pradesh.

Agricultural risk is associated with adverse outcomes that stem from unpredictable biological, climatic and price variables. The risk increases manifold when it comes to long term crops like potato and ginger, as the land is scarce. The crop duration for potato is around 3 to 4 months, and for ginger, it comes to nine to ten months. Agricultural risk can be explained as production risk, market risk, financial risk and credit risk, political risk (regulation and policy changes) and personal risk (**Planning commission** report 2007-12). The state is far behind the developed countries in respect of both the productivity and post-harvest technology.

As profit is the reward of bearing risk, the task is to manage risk effectively within the capacity of farmer and government in a way so that it can withstand adverse outcomes. This paper deals with the risk with relation to production, marketing and processing, which hinder the growth of the agriculture sector, particularly potato and ginger of Himachal Pradesh; and ways to effectively manage it.

II. REVIEW OF LITERATURE

The agricultural risks affect farm activities and livelihood of the farmer and the entire value chain, related businesses and intermediaries, and the economy as a whole on a broader level. Risk is a fundamental reason why a business may not be profitable, nor reach its potential, or not be sustainable over time. It has been discussed in the paper that risk is composed of three elements: threat, uncertainty and loss. In this sense, the risk is the threat of loss or damage caused by an unfavourable event, which is uncertain and that event can be both the result of natural hazards or human activities. **(Tedesco, Ilaria. 2019).** Realising the importance of cash crops, many farmers are diverting their resources to the production of potato and ginger. Not only do these crops can be mixed crops providing farmers with a sense of security as compared to other cash crops which cost high on pocket pre and post-harvest when compared to these crops, but as high risks are also involved on farmer part when investing his resources (**Pandaraiah and Sashidar, 2015)**

Risk management means finding a portfolio of risky prospects that is most efficient for each farmer. Picking a strategy to share risk with others as per the farmer's point of view and in contrast to on-farm management strategies. **(Meuwissen et al., 2000**). The State of Himachal is prone to various hazards, both natural and manmade. Main dangers consist of earthquakes, landslides, flash floods, snow storms, droughts, dam failures, fires (domestic and wild), accidents (road, rail, air), stampedes, biological, industrial and hazardous chemicals among others. Another more common form of natural hazards in the hilly state is the frequent occurrences of landslides during monsoons, construction and also in high-

intensity earthquakes. The vulnerability of the geologically young and not so stable steep slopes in various Himalayan ranges, has been increasing at a rapid rate in the recent decade due to inappropriate human activity like deforestation, road cutting, terracing and changes in agriculture crops requiring more intense watering **(National Disaster Management Authority).**

III. NEED OF STUDY

In modern times, it is challenging for farmers to make an adequate profit by the cultivation of traditional food crops. Cost of cultivation is on the rapid hike due to depletion of soil, marginal farmland, diseases, and change in climate and due to change in the pattern of demand. Farmers have to focus more on cash generation and more revenue creation. Given the importance of agriculture in the context of the state economy and a large number of changes brought about in agricultural setup, it is necessary to study the problems and trends in the area, production and productivity under crops in Himachal Pradesh. As evident from the review of literature, there are many issues and problems causing risk for a farmer like limited land, scarcity of resources, shortage of irrigation facilities and lack of awareness; which are inevitably attached to the cultivation of cash crops. Farmer, government, organisations like IARI and CPRI among others are putting in lots of efforts, but there is still potential that is needed to be harnessed, efficient risk management leads to reduction of losses caused by risk as well as increase the profitability, leading to the development and growth of cash crops namely Potato and Ginger in Himachal Pradesh. The proposed study has been undertaken to identify the risk involved and its management in Himachal Pradesh.

OBJECTIVE

To identify the risk factors in the growth of potato and ginger in Himachal Pradesh and risk management in agriculture.

IV. RESEARCH METHODOLOGY AND DATA COLLECTION

For evaluating the objective of the study, primary data was collected through personal interview method with the help of a well-structured and pre-tested schedule for the year 2016-17. A field survey was undertaken to work out the demographic profile of farmers, socio-economics, factors contributing to the production and the constraints in the production of these crops in the state of Himachal Pradesh.

In order to get the desired information from the respondents, a sample of respondents has been selected; Multistage sampling has been used to conduct the research study:

- **At first stage**: Out of 12 districts of the state of Himachal Pradesh, three districts namely Shimla, Sirmaur and Solan have been purposively selected for the study. Two factors influenced the selection of the districts. First, in these districts, the cultivation of high-value crops, namely potato and ginger, is being practised since the late sixties and early seventies.
  Second, these districts are selected by highest production of potato and ginger, i.e. both potato and ginger are produced in these districts, and the productivity is highest when are put to comparison with other districts of Himachal Pradesh.
- **At Second Stage:** 2 administrative blocks from each of district have been selected based on the highest number of ginger and potato growers.
- **At Third Stage:** 3 village Panchayats from each selected block have been selected by maximum average and a minimum average of these cash crops.
- **At Forth Stage:** 20 potato and ginger producers have been selected from each village Panchayat keeping in view different demographic features.

TABLE 1
SAMPLE SIZE

Sr. No.	Districts	Blocks	Respondents
1	Sirmour	Rajgarh	60
		Shillai	60
2	Solan	Solan	60
		Kandaghat	60
3	Shimla	Mashobra	60
		Narkanda	60
Total	3	6	360

V. RESULTS AND DISCUSSION

5.1 Understanding Risk In Agriculture

Risk is inescapable in agriculture, as agriculture is full of uncertainties like weather, irrigation, variety and health of seed, yields, prices, market, government policies and strategies and other such factors. Also, the probability of a damaging event and unforeseen consequences of such event on agriculture is known as agricultural risk.

TABLE 2 AGRICULTURAL RISK	
SOURCE	**TYPE OF RISK**
Production Risk	• Non-availability or lack of agricultural inputs • Climate change/ Weather events • Diseases and infestations • Pests
Human Resource Risk	• Lack of manpower • Lack of expertise • Sickness and accidents
Financial Risk	• Lack of finances/ Liquidity • Non- availability/ Lack of debt • Change in Interest rates
Market and Price Risk	• Lack of infrastructural facilities • Input price volatility • Output price volatility • Change in consumer preference
Political Risk	• Change in Government policies and schemes • Other political changes • Change in industrial policies • Agricultural insurance changes
Other Risk	• Technological changes • Support and logistics • Cold chain absence

In Table 2, it has been tried to divide the agricultural risk categorically to get a better understanding. Production risks are the risks which affect the production of crops like non-availability of inputs required for production, climate change, diseases, infestation and pest menace as other; human resource risk includes lack of manpower, expertise; financial risks include risk about required finances; market and price risk include lack of markets, volatility in prices of inputs and outputs; Political risks and other risks like technological changes, risk from inadequate support, storage, transportation and logistics.
In the study, agricultural risks are identified as problems by the respondents engaged in the production of ginger and potato; factor analysis is done to identify significant risks associated with the growth of potato and ginger.

5.2 Factors Hindering Growth of Potato and Ginger: Factor Analysis
The Kaiser-Meyer-Olkin
The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy has been used to examine the appropriation of factor analysis. Higher values between 0.5 and 1 indicate that factor analysis is appropriate. The results of the Kaiser-Meyer-Olkin (KMO= .880) measure of sampling adequacy and Bartlett's test of sphericity with highly significant value indicates the appropriate use of factor analysis.

Table 3 KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.800	
Bartlett's Test of Sphericity	Approx.Chi-Square	7128.751
	df	300
	Sig.	.000**

**Significant at .05 level of confidence

Total Variance Explained

Table 4 shows how many variables can be clubbed together to make a single factor. Eigenvalue represents the amount of variance associated with the factor. Therefore, only factors with eigenvalue more than one are retained. Seven factors have been derived from twenty-five variables, which show 74.982 per cent variance.

Table 4
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.251	25.005	25.005	6.251	25.005	25.005	6.236	24.942	24.942
2	3.396	13.582	38.587	3.396	13.582	38.587	3.238	12.952	37.894
3	2.988	11.952	50.539	2.988	11.952	50.539	3.063	12.252	50.146
4	2.373	9.494	60.033	2.373	9.494	60.033	2.329	9.315	59.461
5	1.439	5.755	65.788	1.439	5.755	65.788	1.457	5.828	65.289
6	1.268	5.071	70.859	1.268	5.071	70.859	1.338	5.352	70.641
7	1.031	4.123	74.982	1.031	4.123	74.982	1.085	4.341	74.982
8	.868	3.471	78.453						
9	.844	3.377	81.830						
10	.709	2.835	84.665						
11	.585	2.340	87.005						
12	.478	1.911	88.917						
13	.433	1.732	90.649						
14	.390	1.562	92.210						
15	.377	1.510	93.720						
16	.334	1.337	95.056						
17	.264	1.057	96.114						
18	.237	.949	97.063						
19	.221	.882	97.945						
20	.137	.547	98.492						
21	.121	.485	98.977						
22	.094	.375	99.352						
23	.090	.359	99.711						
24	.058	.231	99.942						
25	.014	.058	100.000						

Extraction Method: Principal Component Analysis.

Source: Data collected through questionnaire

Table 5, which shows, the component matrix results reveals the loadings of the twenty-five variables on the seven factors extracted. The higher the absolute value of loading, the more is the factor contributors to the variable. Thus, it is clear from the table that factor one contributes the most followed by second, third, fourth, fifth, sixth and seventh in descending order.

Table 5
Component Matrix[a]

Statements	Component						
	1	2	3	4	5	6	7
Timely availability of seeds	.987	-.017	-.008	.012	-.043	-.025	.003
Adequate irrigation facilities	.946	-.026	-.007	-.048	-.027	-.082	.024
Availability of packaging & grading material	.895	.074	-.036	-.031	-.036	.085	.002
Manures and fertilisers available when required	.869	-.111	.019	.064	.090	-.170	-.044
Adequate availability inputs	.856	-.102	.059	.139	.146	-.109	-.025
Location of seed distribution center	.854	-.078	-.007	-.118	.003	.068	.114
Availability plant protection material	.790	.114	-.069	-.009	-.112	.104	.015
High cost of transportation	.789	-.105	-.027	-.130	-.004	.059	.003
Pests, insects and rodents cause spoilage	.055	.793	-.481	-.121	-.001	.035	.004
Long term crops	.107	.761	-.412	-.055	.028	.027	-.066
Disease problem is frequent	.014	.706	-.507	-.173	.168	-.077	.031

Dependence on rainfall for irrigation	-.151	.524	-.233	-.195	.190	.118	.340
Impact of climate change on production	.164	.464	-.373	-.020	-.189	.019	-.189
Abundent credit facilities for ginger potato	.056	.546	.754	-.090	-.101	-.063	-.001
Storage_facilities	.043	.513	.745	-.132	-.073	-.049	-.017
Cooperatives and banks always co-operate	.027	.349	.731	-.081	.152	-.157	-.013
Extension facilities are helpful	.062	.515	.622	-.024	.137	-.040	.033
Cost of logistics justified	-.021	.222	-.071	.836	.142	-.088	.101
High income generation	-.017	.200	.003	.818	.198	-.108	.009
Selling price is affected by surplus crop	.132	.103	.012	.796	.055	-.079	.064
Bad notions attached to nutritientnal value of potato and ginger	.091	-.139	-.006	-.040	.771	.137	-.353
Shift towards processed	-.011	-.113	.085	-.258	.716	.313	.134
Confusion selection of variety	.097	.040	.236	.175	-.221	.656	-.262
Grade specification	.001	.232	.057	.282	-.115	.604	-.308
Number of processing units	.083	-.070	.107	.128	-.047	.448	.732
Extraction Method: Principal Component Analysis.							
a. 7 components extracted.							

Rotated Component Matrix

In order to refine the study and improve the interpretability, the variables are rotated by using varimax rotation to find the underlying constructs and their relationship. The variables are chosen to represent the various components hindering the growth of Potato and Ginger. The result of the rotated component from under table 5 identifies seven important underlying components which are most correlated.

Table 6
Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
Timely_availability_ofseeds	.986	.019	.020	.033	-.041	.024	-.009
Adequate_irrigationfacilities	.949	.019	.029	-.013	-.035	-.051	-.018
Availabilitypf_packaging_grading_material	.888	.118	.031	-.012	-.009	.107	.037
Manures_fertilisers_arealwys_available	.874	-.083	.008	.110	.055	-.110	-.115
Locationof_seeddistribution_center	.859	-.005	-.011	-.103	.036	.003	.129
Adequate_availability_inputs	.857	-.103	.032	.185	.111	-.061	-.067
Highcost_of_transportation	.796	-.020	-.043	-.127	.044	.034	.025
Availability_plant_protection_material	.781	.157	.012	-.005	-.086	.137	.056

Pests_insects_rodents_spoilage	.019	.933	.030	.022	-.067	.033	-.012
Disease_problem_isfrequent	-.013	.891	-.010	.012	.073	-.138	-.042
Longterm_crops	.070	.861	.066	.081	-.036	.070	-.074
Dependence_onrainfall	-.171	.607	.099	-.056	.136	-.113	.337
Impact_ofclimatechange_onproduction	.143	.575	-.073	.015	-.202	.153	-.181
Abundent_credit_facilities_forginger_potato	.019	.046	.928	-.021	-.130	.102	.013
Storage_facilities	.009	.033	.907	-.064	-.090	.099	.004
Cooperatives_banks_always_coperate	.001	-.092	.829	.022	.102	-.057	-.043
Extension_facilitiesare_helpful	.025	.100	.805	.087	.086	.042	.045
Cost_logisticsjustified	-.051	.090	-.013	.880	-.036	.040	.058
High_income_generation	-.047	.037	.044	.867	.029	.051	-.029
Sellingprice_affected_bumper_crop	.108	-.046	-.003	.804	-.091	.079	.035
Bad_notionsattached	.085	-.049	-.054	.053	.825	.050	-.263
Shifttowards_processed	-.011	-.031	.037	-.161	.789	-.036	.253
Confusion_selection_ofvariety	.071	-.114	.098	-.001	-.022	.782	.079
Grade_specification	-.037	.124	.047	.160	.031	.751	.004
Numberof_processing_units	.082	-.104	-.009	.078	-.021	.103	.862

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

The variables are chosen to represent the various factors resulting in hindrances in the growth of commercial crops, namely potato and ginger in Himachal Pradesh. The result of the rotated component matrix drawn above table identifies seven important underlying factors which are most correlated. The first factor, i.e., **shortage in required inputs** includes load on the scarcity of seeds, procuring manures and fertilisers, plant protection material, other inputs, irrigation facilities, packaging and grading material, expensive transportation and seed distribution centre. It implies that the timely availability of seeds and irrigation facilities are the main reasons that result in a decline in the growth of these crops. The first factor explained 25.005 per cent of the variance. The loading of the variables first, second, third, fourth, fifth, sixth, seventh and eighth on the First Factor is .986, .949, .888, .874, .859, .857, .796 and .781 respectively.

The second important factor, i.e., **climatic conditions and other natural factors** represents five variables namely spoilage due to pests, insects and rodents, disease, long term crops, rainfall shifts and finally change in climatic conditions respectively. This second factor explained 13.582 per cent of the variance. The loading of the variables first, second, third, fourth and fifth is .933, .891, .861, .607 and .575 respectively.

The third factor, i.e., **lack of support from government bodies,** finds its identification with variables like lack of credit facilities for potato and ginger, non-cooperation by bank officials, inadequacy in extension facilities and lastly acute storage facilities**.** This third factor explained 11.952 per cent of the variance. The loading of the variables first, second, third and fourth on the third Factor is .928, .907, .829 and .805. It is further revealed by the study that lack of support by the government by way of motivational policies, difficulty in banking, improper implementation of extension facilities and acute to no storage facilities are majorly contributing factors in stagnation and even decline in growth of Potato and Ginger.

The fourth category, **inadequate income generation,** is identified with weight on three factors, which include insufficient income generation; the cost of production and logistics is very high, lesser benefits for surplus crops. This fourth factor explained 9.494 per cent of the variance. The loading of the variables first, second, and third on the fourth Factor is .880, .867 and .804 respectively. It can be concluded that **high costs and comparatively lesser prices** threaten the growth of Potato and Ginger in hilly areas, even if the farmers experience bumper production it is a setback the reason being decreased prices, surplus crop at times itself is the risk causing factor.

The fifth factor, i.e., **shifts in consumer attributes** includes an increase in the intake of processed food and wrong notions attached to Potato and Ginger. The fifth factor explained 5.755 per cent of the variance. The loading of the variables first and second on the fifth Factor is .825 and .789, respectively. It can be concluded that the scope for demand is crushed by a shift in consumer attributes like intake of more and more processed items and association of wrong notions like weight gain with Potato and hot effect with Ginger creates problem in demand, particularly in areas under study and hilly area in general.

The sixth factor, **lack of technical know-how** includes load on lack of grade specifications and confusion in selection of variety. This factor explains 5.071 per cent of the variance. The loading of the variable first and second on factor is .782 and .751. It is further revealed by the study that the growth of potato and ginger is adversely affected due to various options among different varieties for cultivation.

The seventh and the last factor, **lack of processing units** include lack of processing units in areas. This factor explains 4.123 per cent of the variance. The loading of the first and the only variable is .862. The communality of the factor is 74.982 per cent, which means approximately 74.982 per cent of the variance in the original variable is being captured by the extracted factors. It is further revealed by the study that lack of processing units in area or only limited processing constitutes to the problem in the growth of Potato and Ginger resulting production in less area for local markets, table varieties only or for self-consumption by farmers.

Reliability Statistics

The results of reliability statistics have been presented in table 6.3.6. The reliability of the construct is determined by computing the Cronbach's alpha. Cronbach's coefficient alpha value of 0.6 is considered acceptable for exploratory purposes, 0.7 is considered adequate and 0.8 good for confirmatory purposes.

Table 7
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.774	.774	25

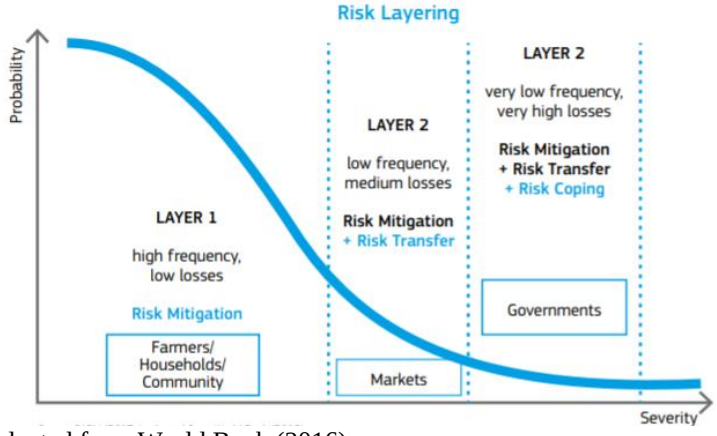
Above table reveals that the Cronbach's Alpha value based on standardised items obtained is .774, which shows high reliability of the scale, therefore it is valid to use this scale.

VI. RISK MANAGEMENT STRATEGIES IN AGRICULTURE

(Miller A., Dobbins Craig et al. 2004) Economic theory suggests a trade-off between risk and returns, i.e. people who accept higher risk should expect higher returns assuming there are no other alternatives with equal returns less risky. Selecting the appropriate risk-return tradeoff is a critical management decision. Managers have a variety of mechanisms for managing risk. The best method of managing risk depends upon the nature of the risk involved. Four general procedures for managing risk are: (1) avoidance, Farmer can manage risk by avoidance, for example, he can cure the seed of potato and ginger with fungicides to avoid seed wastage because of fungus. (2) Reduction of risk means not altogether avoiding risk, but reducing it, for example, potato and ginger are long term crops, but mixed cultivation can help in reducing risk. (3) assumption/retention of risk include accepting risk for higher profits, and (4) transfer of risk can be done by transferring risk to someone else for fees, contract farming, or crop insurance where risk cannot be avoided but is accepted at it is for higher returns.

Risk management tools are essential to enable farmers to anticipate; avoid and react to the uncertainty of the threat despite the diversity of contexts and approaches to managing risks. Risk management strategies should be identified and implemented before risk events; some ex-ante plans provide for future actions to be taken as well as on an ex-post basis, carried on after the event. Reacting to risks entirely on an ad-hoc basis is usually a more costly risk management option **(PARM, 2017a).**

FIGURE 1
RISK MANAGEMENT STRATEGIES AND RISK LAYERING



Source: PARM (2017a) adapted from World Bank (2016)

The analysis of agricultural risk can be done using three approaches based on the above stated three layers of risk, which require three different responses:

- Normal variations in production, prices and weather do not need specific policies from a government. These can be easily managed by farmers themselves as part of usual business strategy, via the diversification of production or the use of production technologies which make yields less variable.
- In between the normal and the catastrophic risk layers lies a marketable risk layer that can be handled through market tools, such as insurance and futures markets, or through co-operative arrangements between farmers. Examples of marketable risks include hail damage and some variations in market prices.
- At the other extreme, non-recurrent but catastrophic events that affect many or all farmers over a wide area will usually be beyond farmer's or market's capacity to cope. A severe and for example, widespread drought, governments must intervene in case of such happening as it is beyond the ability of the farmer to manage such risk.

Table 8
Risk Management Strategies In Agriculture

		Informal Mechanisms	Formal Mechanisms	
			Market-based	Publicly provided
Ex-Ante Strategies	On-farm	• Avoiding exposure to risk • Crop diversification and inter-cropping • Plot diversification • Mixed farming • Diversification of income source • Stock accumulation for price stabilisation. • Adoption of advanced cropping techniques (fertilisation, irrigation, resistant varieties)		• Agricultural extension • Supply of quality seeds and inputs, among others. • Pest management systems. • Infrastructures (roads, dams, irrigation systems)
	Sharing risk with others	• Crop sharing • Sharing of agricultural equipment, irrigation sources. • Informal risk pool	• Contract marketing • futures contracts • Insurance	
Ex-Post Strategies	Coping with shocks	• Reduced consumption patterns • Deferred / low key social & family functions • Sale of assets • Migration • Reallocation of labour • Mutual aid	• Credit	• Social assistance (calamity relief, food-for-work) • Rescheduling loans • Agricultural insurance • Relaxations in procurement procedures • Supply of fodder • Cash transfer

Source: Planning commission report on risk management in agriculture, IX five year plan

Table 8 makes it clear that risk management strategies can be divided into two main courses of actions, namely Informal and Formal Mechanism. These strategies can be ex- ante or ex-post based on their nature. In the case of ex-ante strategies; on the farm, an informal mechanism include avoiding exposure to risk, crop diversification or inter-cropping, mixed farming, plot diversification, stock accumulation for price stability and adoption of advance cropping techniques. The formal mechanism for the same include facilities provided by the government like agricultural extension, the supply of quality seeds and inputs, pest management systems, and Infrastructural facilities among others. However, there is no on-farm market based ex-ante strategy for dealing with probable risk.

Ex-ante strategy for sharing the risk can be either formal or informal. Where informally farmers can exercise crop sharing, sharing of equipment, irrigation and resources and informal risk pool. On the other hand, formal strategies are market-based like contract marketing, future contracts and insurance.

Ex-post strategies can be either informal, i.e. on the farm or formal, i.e. market-based or provided by the government. Here informal, farm-based strategies include: reducing consumption pattern, low social and family functions, sale of assets, migration, reallocation of labour and mutual aid. However, market-based can include credit facilities and government based include social assistance, rescheduling loans, agricultural insurance, relaxation in procurement procedures, the supply of fodder, extension facilities and cash transfer into farmers account.

VII. SUMMING UP

The process of agricultural transformation is taking place in Himachal Pradesh, wherein the traditional cereal crops based subsistence farming system is giving way to high-value cash crops. This process will further intensify, as the process of commercialisation of agriculture will further spread to those areas where presently infrastructure facilities, such as rural roads, marketing and credit are lacking. The main problems which the hill agriculture is facing are the small size of land holdings, lack of irrigation facilities, low consumption of organic and chemical fertilisers, lack of road infrastructure and blockade of roads during rainy seasons.

The governments have to play a primary role in facilitating right conditions by providing information to stakeholders, regulation and training for the development of market-based risk management tools. Risk management tools include futures, insurance and marketing contracts. Farmer should assess all risks and their relationships with each other. Governments should focus on increasing co-operation and communication with stakeholders and understand the capacity of farmers to manage risk and provide the additional resources needed to improve responses.

A long-term approach is necessary, as this allows agricultural stakeholders involved to become aware, empowered and resilient to agricultural risk. Farmers and government need to create a platform together to develop appropriate practices and policy solutions to assist stakeholders, in particular farmers and governments, in responding to the range of risks they face, through a participatory approach. The risk involved in the production of ginger and potato as long term crops can be mitigated by intercropping of tomato and peas and other such cash crops. Active post-harvest management can go a long way to decrease the risk, storage, processing and transportation to markets with demand are potent tools for risk management

Although Himachal Pradesh Government has taken up numerous policy measures to overcome these constraints, more emphasis is required to be given to improved road infrastructure, credit facilities to farmers on cheap interest rate irrigation infrastructure should be strengthened, and free educational training should be given to farmers by agricultural and horticultural universities of the state. A risk management system can be seen as a set of complex relations between the sources of risk, the available tools and strategies to deal with them, and government measures. It is difficult to determine the level of risk that exists in the system because the observed level of riskiness is partially determined by farmers' risk management strategies and government policy. In turn, government risk-related policy is a response both to the agricultural risks that exist, and farmers' strategies to deal with them. Hence it can be said that because risks and responses to them across different institutional levels are thought to be interrelated, no individual tool or policy can be analysed in isolation.

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