



Risk and Uncertainty in Agriculture

Dr. Harkesh Kumar Balai¹ and Kareena²

¹Assistant Professor, Faculty of Agriculture, Jagannath University, Chaksu, Jaipur

²Student, B.Sc. (Hons) Agriculture, Jagannath University, Chaksu, Jaipur

*Corresponding Author's email: preetiphogat638@gmail.com

Agriculture operates in a highly dynamic environment characterized by both risk and uncertainty. Farmers constantly face unpredictable conditions such as excessive rainfall, drought, pest and disease outbreaks, lack of market access, and fluctuating prices. These factors make farming inherently unstable and challenging, affecting both production and income. A clear distinction between risk and uncertainty is essential in understanding agricultural decision-making. As explained by Frank H. Knight, risk refers to situations where the possible outcomes and their probabilities of occurrence are known or can be estimated. In such cases, risk can be managed effectively—for example, insurers can calculate probabilities and design policies with premiums that cover potential losses while ensuring profitability. In contrast, uncertainty arises when neither the outcomes nor their probabilities are known. This makes it far more difficult to predict or manage, as there is no reliable basis for planning or risk coverage. Under such conditions, even insurance mechanisms become ineffective because it is impossible to determine an appropriate premium. Thus, while risk in agriculture can be measured and managed to some extent, uncertainty remains a more complex challenge, requiring adaptive strategies and informed decision-making by farmers and policymakers.

Types of Risks and Uncertainties

They are classified into five categories:

- 1. The economic uncertainties** are markedly reduced in many economies where input and product prices are announced before sowing a crop. Economic uncertainties of this nature are usually caused by national and international policies which are beyond the approach of an individual farmer.
- 2. Biological uncertainty** is quite common and important in agriculture. Rains or drought, floods, hailstorms, frost, etc., may all affect the yields in agriculture directly or indirectly by increasing the incidence of crop or animal diseases.
- 3. Technological uncertainties:** Continuous advancement of knowledge through research activities has made more efficient methods increasingly available for agriculture. Simultaneously, new inventions and innovations may result in an increased efficiency of the existing methods. Thus, improvement of knowledge which is continuous phenomenon may render some techniques less efficient and finally obsolete. Such a change is known as technological progress in agriculture can be found in different methods of cultivation and in fertilizer, irrigation and chemical applications giving different yield responses. Technological improvement necessarily implies that the same level of input can now produce larger quantities of the produce.
- 4. Institutional uncertainties:** Institutions like government, banks, etc., may also cause uncertainties for an individual farmer. Crop cess, credit squeeze, price supports, subsidies, etc. may be enforced or withdrawn without taking an individual farmer into confidence. This type of uncertainty may also result in non-availability of resources in appropriate quantities

and at the appropriate time and place (eg subsidized fertilizer in Kenya, which is sometimes not available or accessible to farmers during harvest and this delays planting).

5. Personal uncertainties

The farm plan may not be executed because of some mishap in the farmer's household or in his permanent labor force.eg (farmer may fall sick).

Strategies employed by farmers to deal with/ mitigate risks

1. Insure against Risk: Insurance policy reduces income variability arising from risk. For instance, crop insurance plans have the effect of making the farmer's income from one year to the next more even. When a crop fails, an insured farmer will be compensated and will be able to produce for the next season.

2. Contracts: Contract allows sell a specified commodity at a specified price for delivery at some future point in time. They help reduce or eliminate price uncertainty by determining prices to be paid after harvest, or at the point when the commodity is ready for market. The futures market is but one contractual arrangement for eliminating price uncertainty. Contractual arrangements are commonly used for commodities such as horticultural crops.

3. Selection of enterprises with low variability: There are certain enterprises where the yield and price variability are much lower than for others. For example, wheat has relatively much less variability in its yields and prices in irrigated regions than potato. Thus, the inclusion of enterprises with low variability in the farm plans provides a good way to safeguard against risk and uncertainty.

4. Flexibility: This refers to the convenience with which the organization of production on a farm can be changed. Some organizations are obviously more flexible than others and flexibility in an organization through change in production helps obtaining advantages and improvements in the economic and technological environment of a farmer. As an uncertainty safeguard, flexibility may be built into farm plan for stabilization of incomes from year to year and to maximize the expected stream of total income over a longer period of time. It differs from diversification in the sense that it aims at preventing the sacrifice of large gains as compared to the prevention of large losses through diversification. Due to technological and economic changes certain enterprises may suddenly gain or lose importance over time. Thus, quick changes may be required which can only be brought about at a low cost if the plans are not rigid but flexible. Flexibility can be of the following types:

□ **Time flexibility:** Time flexibility may be introduced either through proper selection of products or production methods or partly by both. Orchard plantation is a relatively more rigid enterprise than annual crops like wheat, maize, paddy, etc. A short-lived farm structure or equipment is more flexible than one which durable.

□ **Cost flexibility:** whenever time flexibility is of limited use, cost flexibility becomes important. Cost flexibility refers to variations in output within the structure of a plant with a longer life. Extension or contraction of output, whenever desired by favourable prices or yields, can be brought about at lower costs for a given plant. Though a farmer may find that owning a potato digger on his farm would result in lower costs than those which have to be paid for custom hiring a similar one, yet he may keep on hiring machine in order to have more cost flexibility on his farm.

□ **Product Flexibility:** product flexibility, like any type of flexibility, aims at changes in production in response to price signals. In this category we consider the form of physical resources, e.g. machines, farm structure, etc., which can be switched readily from one product to another. If a farmer is to adjust to changing relative product and input prices, it must be possible to adapt buildings and equipment lasting more than one production season to alternative uses as input and output price ratios change.

5. Diversification: Diversification is a very important, useful and popular method to safeguard against risk and uncertainty in agriculture. It involves mixing two or more enterprises. Diversification enables profits from one type of enterprise offset losses in another enterprise. The strategy may be more effective for dealing with price uncertainty. The ideal

strategy would involve locating commodities whose prices always move in opposite directions.

6. Government Programs: These are programs that provide price and income support for farmers. The program has been directed toward the reduction of price uncertainty.

Government price support programs places floors under which commodity prices are supported. Such programs increase incomes and support the welfare of every farmer who participates, large and small. Participation in a program reduces income variability and raise net farm incomes as opposed to nonparticipation. Thus, participation in the program requires farmer to make decision by; calculating net revenue when the farmer participates. This usually means a restricted output (y) at a high price. Calculating net revenue when the farmer doesn't participate. This assumes more output but a lower price. However, the decision by the farmer to participate or not participate will be based both on the extent to which participation in the program will reduce income variability as well as increase net income. When government support prices exceed levels at which supply and demand are in equilibrium, surpluses of the price-supported commodities occur. Most commodities cannot be stored indefinitely, and storage costs can quickly become rather high. In the past, the government has used the school lunch program to dispose of surplus, government owned commodities. Recently the government has distributed surplus dairy products occurring as a result of the price support program to low income and elderly residents.

7. Liquidity and asset management: It is a form of flexibility but has been put in a distinct class because it represents a different method of management used in case of unpredictable changes on a farm. Liquidity refers to the ease with which the assets on a farm can be converted into cash can also change its form in a relatively short time. If the assets are held in a form which can be easily converted into cash, it provides a safeguard to the farmer by enabling him to make necessary adjustments in response to risk and uncertainties of various types. Eg (in times of drought in Turkana, farmers can decide to sell their livestock and replace them back when drought is over)

Role of Government and Institutions in Managing Risk and Uncertainty

- **Price Support and Market Intervention:** Government protects farmers from price fluctuations by announcing MSP and procuring crops. Platforms like e-NAM improve market access and help farmers get better and more stable prices.
- **Crop Insurance Schemes:** Schemes such as Pradhan Mantri Fasal Bima Yojana provide financial protection against crop failure. Farmers pay a small premium while the government shares the burden, reducing income uncertainty.
- **Institutional Credit and Financial Support:** Institutions like National Bank for Agriculture and Rural Development ensure availability of affordable credit. This reduces dependence on moneylenders and helps farmers invest in productive inputs.
- **Irrigation and Infrastructure Development:** Government investment in irrigation reduces dependence on rainfall and minimizes climatic risk. Programs like Pradhan Mantri Krishi Sinchai Yojana aim to provide reliable water supply to farms.
- **Research and Extension Services:** Organizations such as Indian Council of Agricultural Research develop improved seeds and technologies. Extension services help farmers adopt modern practices, reducing production risk.
- **Disaster Relief and Compensation:** In case of natural calamities, the government provides compensation and relief packages. This support helps farmers recover losses and continue agricultural activities.
- **Market Infrastructure and Storage:** Development of warehouses and cold storage facilities helps reduce post-harvest losses. Farmers can store produce and sell when market prices are favorable, reducing price risk.
- **Policy Support and Regulation:** Government policies like subsidies, trade regulations, and input support stabilize agriculture. These measures reduce cost burden and protect farmers from market uncertainties.

- **Promotion of Farmer Organizations:** Farmer Producer Organizations (FPOs) and cooperatives increase bargaining power and reduce individual risk. Collective action helps in better marketing and access to resources.
- **Role of International Institutions:** Organizations like Food and Agriculture Organization and World Bank provide technical and financial support. They help countries design policies to manage agricultural risks effectively.

Conclusion

Risk and uncertainty are inherent features of agriculture due to its dependence on natural, biological, and market forces. While risks can be measured and managed through tools like insurance, diversification, and institutional support, uncertainty remains more complex as it involves unpredictable outcomes with no clear probabilities. Effective management of these challenges requires a combined effort from farmers, government, and institutions. Support mechanisms such as price policies, crop insurance, credit facilities, and technological advancements help in reducing vulnerability and stabilizing farm income. In the long run, strengthening agricultural infrastructure, improving access to information, and promoting sustainable farming practices are essential for minimizing the adverse effects of risk and uncertainty. A resilient agricultural system not only ensures farmers' livelihoods but also contributes to overall economic stability and food security.

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