

RISK ASSESSMENT, ADAPTATION STRATEGIES, AND RISK MANAGEMENT FRAMEWORK FOR HAILSTORMS IN NORTHERN BANGLADESH

EXECUTIVE SUMMARY

Background of the research

The world is facing a multitude of climate change and environmental issues. Hailstorm is an extreme weather event (EWE) that occurs generally over a small scale; however, regardless of its localized occurrence, it is considered a significant natural hazard that leads to substantial economic losses to the agricultural sector, property, and livelihoods. Most of the existing research demonstrates the climatology of thunderstorms and hailstorms, and their causes and consequences. Still, there are significant research gap in the community risk assessment of hailstorm, farmers adaptation strategies, and risk management. The risk and vulnerability analysis of hailstorms and their management to the agricultural sector is highly overlooked globally and in developing countries like Bangladesh, known as a climate change hotspot. Thus, this research aims to assess the community level hailstorm risk and propose a sustainable risk management framework.

Research Objectives

1. To analyze the spatial and temporal distribution of hailstorms and their risks to agriculture.
2. To examine the farmers' hailstorm risk perceptions and the determinants influencing the risk perceptions.
3. To investigate the adaptation strategies practiced by the rural farmers to combat the risk of hailstorms and the influence of different factors on adaptation behavior.
4. To identify the hailstorm risk management measures and their relative importance.
5. To develop a hailstorm risk management framework for strengthening the farmers' capacity to deal with the hailstorms risk.

Research Methodology

The study used mixed methods including a set of quantitative and qualitative methods to achieve the research objectives. The study areas were four districts in northern Bangladesh (Panchagarh, Nilphamari, Dinajpur, and Rangpur). For fulfilling the first objective, different PRA tools were used. Two widely used quantitative and qualitative models named SMUG (seriousness, manageability, urgency, and growth) and FEMA (Federal Emergency Management Agency) were employed to

collect the data and prioritize hazards based on their risks. For attaining the second objective and third objective, a questionnaire survey was conducted. The Pearson's product-moment correlation coefficient and Spearman rank correlation coefficient methods were employed depending on the nature of variables. I have applied binary logistic regression analysis and multiple regression analysis. The activity-based adaptation index was calculated based on the relative importance of adaptation measures and farmers' practice measures. For the fourth objective, the PRA tools and questionnaire survey were used to gather data. SWOT and cross SWOT analyses were conducted to identify the alternative risk management measures. For fifth objective, the findings from previous studies were used.

Key findings

The temporal and spatial distribution of hailstorms over Bangladesh and the study area showed significant increasing trends. Hailstorm was found to be the most prioritized hazard over droughts and flash floods, as perceived by the community.

The study revealed that the hailstorm risk perceptions of farmers were embodied by subjective risk factors, such as their perceived control of hailstorm risk and personal circumstances. Their perceived resources for tackling hailstorm risk were the most significant predictor of hailstorm risk perceptions. Marginal and smallholder farmers were very vulnerable and perceived more risks than the medium- or large-holder farmers, owing to the lack of post-hailstorm compensation policies.

Findings revealed that farmers perceived the trend of hailstorms in according to the secondary data. All farmers (100%) perceived that climate change was the primary cause of increasing hailstorm frequency, intensity, and distribution. Nearly all the farmers perceived higher impacts of hailstorms on crop production. Farmers adopted a variety of agricultural and non-agricultural measures to cope with the impacts. Positive correlations were found between the perception of hailstorm cognitive factors and the total number of adaptation practices adopted. Age, cognitive perceptions, household assets, and farm size of the respondents contributed mainly to the multiple regression model for adaptation of agricultural measures ($\beta = 0.24, 0.17, -0.14, \text{ and } 0.12$, respectively).

We found 17 measures in total which could be adopted in all the phases of risk management. However, the non-structural measures which involved the community, local agriculture department, and local government (e.g., the recovery and rehabilitation, awareness-raising on the rural people, especially farmers, building community network for forecasting of hailstorm) received more prioritization than the agricultural management measures (e.g., early harvesting, replantation, adjusting planting time, etc.).

The crucial findings from the analytical chapters were subsequently used as substantial inputs for the development of hailstorm risk management framework (HRMF). The HRMF consists of three main sections: assessment, strategy, and action. Figure ES.1 is the proposed framework for hailstorm risk management in northern Bangladesh.

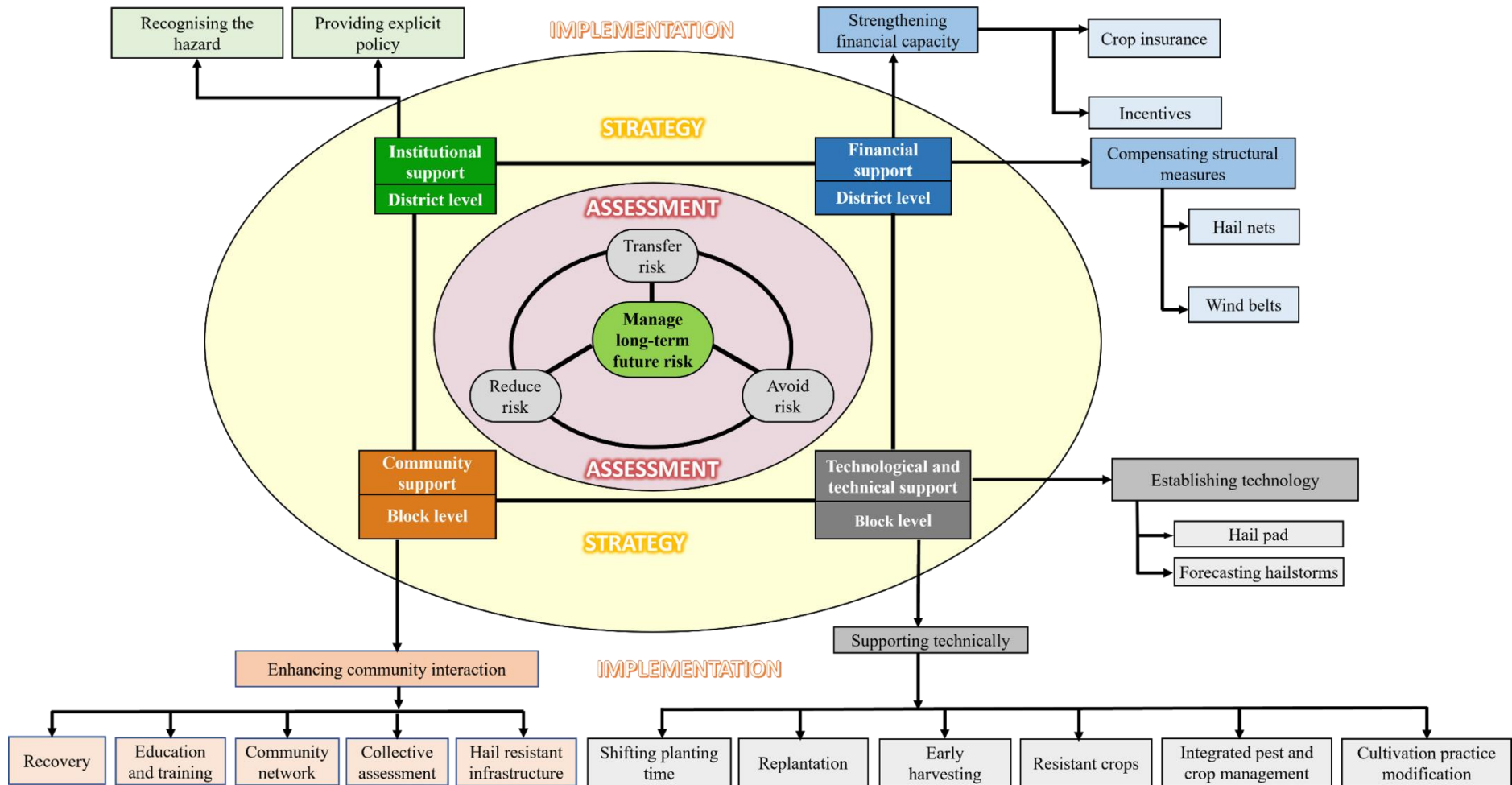


Figure ES.1 Proposed framework for hailstorm risk management in Northern Bangladesh

The assessment section is the foundation of this framework. It suggests the adjustment of the existing policy for hailstorm risk management, which is currently in an ignorant or retainment phase. In addition, the policy should address risk reduction or risk transfer based on the hailstorm risk level over different districts in northern Bangladesh for risk management. In the strategy section, there are four support systems (institutional, financial, technical-technological, and community). Based on the support systems, several actions are proposed. This research asserts that this framework's implication can help manage the hailstorm risks and bolster adaptation behavior of the people to mitigate such inevitable risks and crises. However, the efficacy of this framework is not tested yet.

Conclusions

One of the significant findings of this research is the potential threat of hailstorms to agricultural sustainability, which requires urgent attention from policymakers and the authorities. The study found evidence of the lower adaptive capacity of farmers, which has a broader range of implications in hailstorm risk management and managing other potential hazards. Sufficient training and the provision of technical and logistics supports to enhance the adaptive capacity of the farmers could be efficient tools to improve the adaptive capacity. The research strongly urges introducing a crop insurance model for farmers living in hailstorm-prone areas of northern Bangladesh. The proposed framework for hailstorm risk management can be implemented on a pilot basis to measure the efficacy and practice on a larger scale.