

FARMER ADHERENCE TO WEATHER INFORMATION FOR **CLIMATE RESILIENT**

PADDY CULTIVATION IN SRI LANKA'S RAINFED AND MINOR IRRIGATED AREAS



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Farmer Adherence to Weather Information for Climate-Resilient Paddy Cultivation in Sri Lanka's Rainfed and Minor Irrigated Areas

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FOREWORD

This research report titled “Farmer Adherence to Weather Information for Climate-Resilient Paddy Cultivation in Sri Lanka’s Rainfed and Minor Irrigated Areas” addresses a timely and nationally significant issue, the role of weather information in strengthening the resilience of Sri Lanka’s paddy sector. Paddy cultivation, the backbone of our food security and rural livelihoods is increasingly threatened by erratic rainfall, prolonged droughts and extreme weather events. These climatic shocks threaten both household incomes and national food security. In such a context, the timely, reliable and effective use of weather information is emerging as a crucial tool for strengthening farmers’ adaptive capacity and guiding the adoption of more sustainable farming practices.

This research report provides valuable insights into how smallholder paddy farmers in rainfed and minor irrigated areas access, use and benefit from weather information in their decision-making processes. It highlights the various channels through which weather information is disseminated, assesses its clarity and accessibility and documents both the opportunities and the constraints farmers experience in applying such information. By examining these factors, the study provides a strong evidence base for policymakers, practitioners and development partners to strengthen dissemination mechanisms, bridge communication gaps and design interventions that are locally appropriate, inclusive and practical.

The research is particularly significant because it focuses on rainfed and minor irrigated systems, which are among the most vulnerable to climate risks yet often under-represented in national studies. The findings clearly demonstrate that while farmers are aware of weather forecasts and recognize their value, significant challenges remain in ensuring that the weather information is timely, accurate, easily understood and actionable. Addressing these challenges will require concerted efforts from multiple stakeholders, including government agencies, extension services, farmer organizations and the scientific community. The findings of this report will inform future strategies and policies aimed at building a more climate-resilient agricultural sector in Sri Lanka. By doing so, we can safeguard the country’s food security, protect the livelihoods of farming families and contribute to the broader goal of sustainable development.

Prof. A.L. Sandika
Director/Chief Executive Officer

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EXECUTIVE SUMMARY

Agriculture in Sri Lanka, particularly paddy cultivation in the dry zone, faces acute challenges due to climate shocks and unpredictable weather patterns. Farmers often struggle to make timely management decisions under these uncertain conditions. This research aimed to investigate whether and how smallholder paddy farmers in rainfed and minor irrigated areas of Sri Lanka use weather information (WI) in their crop management, assess the benefits of its use and explore the opportunities and challenges for its effective adoption to build-up resilient agricultural systems. The study surveyed randomly selected 445 paddy farmers under rainfed and minor irrigated systems across districts of Kurunegala, Anuradhapura, Ampara, Batticaloa and Vavuniya. Data were analyzed descriptively and using multinomial logistic regression.

The study revealed that most farmers were aware of WI dissemination mechanisms, particularly through *pre-season* meetings organized by the Department of Agrarian Services, *Wewgam Pubuduwa* of the Department of Irrigation and the Climate Smart Irrigated Agriculture Project of the Ministry of Agriculture. These initiatives were identified as both accessible and influential within farming communities. In terms of dissemination channels, TV was the most widely used with 78 percent of farmers relying on it and this result varies by study location, followed by extension services which reached 60 percent. Digital platforms including mobile applications, text and voice messages and also contributed significantly, especially in Anuradhapura where farmers frequently used TV (34%), extension services (35%) and mobile apps (42%). In contrast, Batticaloa farmers relied more on radio (42%) and farmer organizations (37%).

Among the surveyed paddy farmers, TV was most commonly used channel by those aged 50–64 years, accounting for 41 percent. On the other hand, mobile applications were mainly used by paddy farmers in the age of 35–49 group with 44 percent depending on them. Overall, the majority of WI users were men (76%) while women made up a smaller proportion at 26 percent.

Government agencies primarily the Department of Meteorology, Department of Agriculture and Department of Agrarian Development were the main sources of WI, cited by 97 percent of farmers. Weather forecasts were the most common form of WI, with TV reaching 81 percent and radio 69 percent of farmers, while printed media reached all farmers who accessed WI through it. However, the frequency of access varied: 64 percent of farmers accessed WI occasionally and only 31 percent did so frequently, suggesting that WI was primarily used for specific needs rather than routine daily planning. Although 51 percent of farmers reported that WI was highly accessible, only 40 percent sometimes used it in making farming decisions, with many continuing to rely more on personal experience and traditional knowledge. A large majority of full-time farmers (83%) rated WI sources as very accessible, compared to only 17 percent of part-time farmers.

It was observed that WI was somewhat helpful for 60 percent of farmers in the sample when making farming decisions. For 27 percent of farmers, it was reported to have greatly helped. About 13 percent found it minimally or not useful. Younger farmers were more likely to use smartphones to access WI, while eight percent reported not using any technological devices, highlighting persistent digital divides. Farmers aged 50–64 made up the largest share of those using TV to access WI (45%) while the 35–49 age group had the highest proportion of smartphone users (42%).

Notably, clarity and comprehensibility of WI were also hindered by language barriers, particularly in linguistically diverse districts such as Vavuniya, Batticaloa and Ampara underscoring the need for multilingual dissemination strategies. Approximately 56 percent of the farmers stated that the WI they received was very clear. Nearly 82 percent of farmers in the sample stated that they accessed WI through audiovisual means, such as audio and video clips, which emerged as the most commonly used format.

Nevertheless, several barriers to effective utilization persisted. Over half of the farmers (53%) stated irregular updates as a major limitation while poor network coverage (33%) and lack of compatible devices (30%) further constrained access. In Kurunegala, 56 percent of farmers reported poor network coverage as a challenge. In Anuradhapura, 48 percent were affected by not having suitable electronic devices while 44 percent of farmers in both districts pointed to irregular updates as a problem.

Farmers suggested key improvements, including the provision of more reliable and accurate WI (23%), more frequent updates (20%) and timely dissemination (19%). Kurunegala farmers specifically emphasized the need for better technology (59%) and affordable access options (100%), while farmers in Anuradhapura highlighted the importance of delivering for WI in local languages (44%), underscoring the need for context-specific strategies to enhance the usability and inclusiveness of weather information systems.

WI influenced key farming decisions, including land preparation (71%) harvesting (70%) and pest control (54%). District-level analysis showed that farmers used WI for land preparation in Anuradhapura (34%) and Kurunegala (28%) for selecting paddy varieties in Kurunegala (34%), pest control in Batticaloa (26%) and irrigation scheduling in Kurunegala (35%). However, 63 percent of farmers in Kurunegala reported not using WI for any decisions. WI usage contributed to minimizing crop losses due to climatic hazards (63%) and improved resource management (48%).

Access to WI for farmers is influenced by factors such as internet availability, regional disparities, clarity of communication and information sources particularly media and peer networks. In addition to that, the factors influencing the extent to which WI helped farmers to make decisions in paddy cultivation include the clarity of WI, the perceived usefulness of the information, pre-season meetings and accessibility to information sources.

Overall, the study concludes that effective dissemination of WI - when integrated with traditional knowledge, tailored to district-specific needs, delivered in local languages and made accessible through improved infrastructure and digital platforms — is essential for empowering Sri Lanka’s paddy farmers to build climate resilience. The study recommends strengthening government-led dissemination mechanisms and promoting multilingual and digital dissemination through direct engagement and collaboration with young, progressive farmers. Additionally, it emphasizes the equipping extension officials with advanced global forecasting tools to support adaptive, climate-smart agricultural practices.

LIST OF CONTENTS

	Page No.
FOREWORD	i
ACKNOWLEDGEMENTS	ii
EXECUTIVE SUMMARY	iii
LIST OF CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF APPENDICES	ix
LIST OF ABBREVIATIONS	x
 CHAPTER ONE	 1
Introduction	1
1.1 Background	1
1.2 Problem Statement and Justification	2
1.3 Research Objectives	5
1.4 Organization of the Research Report	5
 CHAPTER TWO	 7
An Overview of Weather Information Used in Paddy Farming	7
2.1 Paddy: As a Climate Sensitive Crop	7
2.2 Climate related Crop Losses and Government Compensation Payments in Paddy Cultivation	8
2.3 Existing Weather Information Services and Channels Available for Paddy Farmers	10
2.4 Access to and Utilization of Weather Information among Paddy Farmers in Sri Lanka	12
2.5 Factors Affecting to Successful Access to and Utilization of Weather Information by Paddy Farmers	14
 CHAPTER THREE	 17
Methodology	17
3.1 Study Locations and Sample	17
3.2 Data Collection Methods	18
3.3 Data Analysis	18
 CHAPTER FOUR	 21
Weather Information Services, Channels Used in Crop Farming	21
4.1 Introduction	21
4.2 Socio-Demographic Characteristics of the Sample	21
4.2.1 Age Distribution of Principal Farmer	21
4.2.2 Educational Attainment of the Principal Farmer	22
4.2.3 Primary Employment of the Principal Farmer	22

4.2.4	Distribution of Monthly Income of Principal Farmer	23
4.2.5	Other Information about Principal Farmers in Sample	24
4.3	Existing Mechanism of Disseminating WI	24
4.4	Weather Information, Weather Information Dissemination Channels and Services	25
4.5	Information related to WI Service Provider	29
CHAPTER FIVE		31
Accessibility and Utilization of Weather Information		31
5.1	Introduction	31
5.2	Access to Weather Information and Use in Crop Farming	31
5.3	Problems Faced in Access to Weather Information	37
5.4	Suggestions to Improve the Access to Weather Information	38
5.5	Usefulness of Weather Information in Decision Making by Paddy Farmers	40
5.6	Dissemination of Weather Information via Government Institutional Set-up: A Case of <i>Pre-Season</i> Meetings	42
5.7	Factors Determining Access to and Utilization of Weather Information	44
CHAPTER SIX		47
Key Findings, Conclusions and Recommendations		47
6.1	Introduction	47
6.2	Key Findings and Conclusions	47
6.3	Recommendations	52
REFERENCES		54
APPENDICES		60

LIST OF TABLES

	Page No.
Table 3.1: Sample Distribution	18
Table 4.1: Distribution of Principal Farmers by Educational Attainment of (Frequency and Percentage)	22
Table 4.2: Information on Primary Employment of Principal Farmer	22
Table 4.3: Distribution of Farmers based on Dissemination Channels and Services of WI	27
Table 5.1: Farmer Access, Utilization and Perceived Usefulness of Weather Information	32
Table 5.2: Association between Socio-economic Variables and Access to Weather Information among Paddy Farmers	33
Table 5.3: Multinomial Logit Estimates for Accessibility of Weather Information	45
Table 5.4: Multinomial Logit Estimates on the Extent to which Weather Information Helped in Farming Decisions	46

LIST OF FIGURES

	Page No.
Figure 2.1: Sum of Acres Indemnity (2021 <i>Yala</i> – 2023/2024 <i>Maha</i>) Crop Wise	9
Figure 2.2: Sum of Total Indemnity (Rs.) (2021 <i>Yala</i> – 2023/2024 <i>Maha</i>) Crop Wise	9
Figure 4.1: Percentage Distribution of Farmers by Age	21
Figure 4.2: Percentage Distribution of Farmers by Monthly Income	23
Figure 4.3: Type of Weather Information Received during 2024 <i>yala</i>	26
Figure 4.4: Service Provider of Weather Information	29
Figure 5.1: Technology/Device Used to Access to Weather Information	35
Figure 5.2: Problems Faced by Paddy Farmers when Accessing to Weather Information	37
Figure 5.3: Suggestions to Improve Access to Weather Information	39
Figure 5.4: Decisions Made based on Weather Information	41
Figure 5.5: Impacts of Weather Information on Farming Practices	42

LIST OF APPENDICES

	Page No.
Appendix A: Sample Selection Areas	60
Appendix B: Other Information of Principal Farmer in the Sample	61

LIST OF ABBREVIATIONS

Als	-	Agriculture Instructors
ADOs	-	Agrarian Development Divisional Officers
ARPAs	-	Agriculture Research and Production Assistants
ASC	-	Agrarian Services Centre
CAPI	-	Computer-Assisted Personal Interviews
CIPs	-	Climate Information Products
CSIAP	-	Climate Smart Agriculture Project
DoA	-	Department of Agriculture
DAD	-	Department of Agrarian Development
DoM	-	Department of Meteorology
FAO	-	Food and Agriculture Organization
IPCC	-	Intergovernmental Panel on Climate Change
IPS	-	Institute of Policy Studies
KNMI	-	Royal Netherlands Meteorological Institute
KIIs	-	Key Informant Interviews
NGOs	-	Non-Governmental Organizations
NRMC	-	Natural Resources Management Centre
PRA	-	Participatory Rural Appraisal
SMS	-	Short Message Service
WI	-	Weather Information
WMO	-	World Meteorological Organization

CHAPTER ONE

Introduction

1.1 Background

Climate variability has an enormous impact on agricultural productivity, rural livelihoods and economic stability at the farm, regional and national levels. One of the daily challenges farmers face is making informed management decisions amidst this uncertainty. In Sri Lanka, agriculture is particularly vulnerable to climate shocks and shifting weather patterns, - impacts that are more pronounced than in many other countries. Rising temperatures and irregular rainfall patterns pose significant threats to national food security in Sri Lanka (Sathischandra *et al.*, 2014).

The country's vulnerability to climate change is evident in the increasing frequency and severity of extreme weather events, such as flash floods and prolonged droughts, which occur more frequently and severely compared to other regions (IMF, 2018). Sri Lanka has experienced significant economic losses due to natural disasters, with flooding and cyclones being the primary contributors (Siriwardana *et al.*, 2018). These climate fluctuations are often linked to intensified La Niña and El Niño phenomena (Sumathipala, 2014; Hapuarachchi and Jayawardena, 2015; Jayawardene *et al.*, 2015; Abeysekera *et al.*, 2019).

Additionally, Sri Lanka's key agricultural regions—particularly in the North, North Central, Western and North Western Provinces—have been identified as climate change hotspots. These areas face elevated risks from rising temperatures, altered rainfall patterns, rising sea levels and extreme weather events (Mani *et al.*, 2018; The World Bank, 2018). Sri Lanka's agriculture sector, a vital component of the country's economy, is grappling with the escalating impacts of climate change-related hazards. The vulnerability of this sector is exacerbated by the country's developing status, with a significant portion of the rural population dependent on agriculture for their livelihoods. In recent years, the frequency of unexpected flash floods and droughts has surged, posing a severe threat to the sustainability of farming practices.

The country experienced a severe drought in late 2016, leading to a 40 percent reduction in paddy production in early 2017. Subsequent heavy rains further exacerbated crop losses, leaving 229,560 households food insecure, particularly affecting rain-fed farmers and agricultural labourers (Coslet *et al.*, 2017). The extreme weather events of May 2017, including heavy rains, landslides and floods resulted in 246 fatalities and the displacement of over 600,000 individuals, ranking Sri Lanka as the second-worst affected in the 2017 Global Climate Risk Index (Eckstein *et al.*, 2019).

Research suggests that Sri Lanka will experience rising temperatures, more intense droughts and increasingly variable rainfall patterns, making agricultural production less resilient (World Bank Group & ADB, 2021). This trend threatens the attainment of

the Sustainable Development Goals particularly those related to food security (Goal 2) and poverty eradication (Goal 1) and exacerbates the existing poverty and climate vulnerability faced by millions of households (World Bank Group & ADB, 2021). However, a growing body of literature suggests that improved access to timely weather information services offers prospects for dryland smallholder paddy farmers to maintain productivity and build resilient agricultural systems in the face of changing rainfall patterns (Jones *et al.*, 2015; Hansen *et al.*, 2019; Singh *et al.*, 2018). Weather information (WI) encompasses a range of forecasts—from short-term weather updates and seasonal outlooks to longer-term climate change projections on decadal timescales (Nkiaka *et al.*, 2019 and Singh *et al.*, 2018). Seasonal climate forecasts, in particular, have received considerable attention due to their significant potential to help buffer agricultural production against climate variability by enabling farmers to minimize risks and maximize opportunities.

WI is now more widely available. Online data portals are becoming useful for communicating climate data (Daron *et al.*, 2015). Portals hosted by organizations such as the Climate System Analysis Group, Royal Netherlands Meteorological Institute (KNMI), World Bank and Potsdam Institute provide users with access to relevant data and information. Creating insights from raw data necessitates post processing expertise and proper analytical tools, and this domain is mostly used by researchers and impact assessment modelers (Singh *et al.*, 2018). WI is increasingly translated and communicated in more user-friendly formats, including agro-advisories for farmers (Dorward, Clarkson and Stern, 2015). Innovative communication methods are also employed to increase adoption. However, the climate community continues to face challenges in providing high-quality, consistent and adequately tailored information.

1.2 Problem Statement and Justification

Today agricultural systems and cropping patterns have evolved and developed on the experience of ancestor and their perceptions of climate variability. These systems, rooted in traditional knowledge, have enhanced through scientific knowledge. Farmers have developed strategies to make crucial decisions about what, when and where to plant. These strategies draw on unique combinations of individual resources, planning, experimentation and improvisation, blending local knowledge with external expertise. However, traditional methods and timing of cultivation have proven ineffective against the challenges posed by climate change.

The recognition of the potential and opportunities inherent in utilizing weather and WI has sparked scientific and institutional initiatives to develop and disseminate climate forecasts in Sri Lanka. Over the past, government and non-governmental organizations have worked on developing platforms and delivering seasonal forecasts to farmers across the country through various channels, prior to the onset of each cultivation season. Recent climate-related disasters, including severe droughts and destructive flooding as well as growing evidence of climate change, have given new impetus to how effective and to what extent farmers apply climate predictive information in their decision-making. To address this reality with knowledge,

significant gaps in the current system concerning institutions, technology, policy, information and resource mobilization must be addressed. Although action is required in each of these categories, the success of these efforts depends on access to appropriate information. It is undeniable that there is a substantial deficit in climate knowledge. To bridge this gap, suitable Climate Information Products (CIPs) are needed and significant progress must be made by Sri Lanka in developing reliable CIPs (Senaratne and Premarathne, 2018).

The scarcity of reliable CIPs to meet the growing demands of various stakeholders is a challenge faced by many developing countries, including Sri Lanka. In Sri Lanka, the Department of Meteorology (DoM) serves as the national provider of WI and is the focal point for the World Meteorological Organization (WMO) and the Intergovernmental Panel on Climate Change (IPCC). Currently, the DoM offers a range of CIPs to the public and stakeholders from weather-dependent economic sectors such as agriculture, energy, fisheries, shipping, aviation and insurance. These CIPs are communicated through public media and the DoM's website and include daily weather forecasts, monthly and seasonal outlooks, sea-area and city forecasts, aviation and shipping forecasts and warnings and advisories for severe weather events such as cyclones, heavy rains, lightning and high winds.

The DoM has also begun offering three-day and ten-day model forecasts and is making continuous efforts to develop long-term climate projections through downscaling of global models. Despite these efforts, significant gaps in the availability of CIPs persist. These gaps can be broadly categorized into three types: supply gaps, credibility gaps and communication gaps (Senaratne and Premarathne, 2018).

As climate change impacts gradually unfold, the demand for CIPs is increasing, particularly in weather-dependent sectors such as agriculture, fisheries, water resources management, energy planning and disaster risk management. However, the current supply of CIPs in Sri Lanka is limited compared to this growing demand. Even the available CIPs suffer from credibility gaps due to poor compatibility and quality. Poor compatibility refers to the mismatch between forecast coverage and users' information needs while the quality of forecasts is determined by their accuracy and reliability. Low compatibility and quality reduce user confidence in CIPs, resulting in a credibility gap. Furthermore, the existing CIPs are not effectively communicated. Communication gaps arise from issues with the format and content of messages, low user access due to lack of targeting and poor selection of media for dissemination. These gaps in WI have led to frequent criticisms of the DoM from both politicians and the general public.

To be useful to smallholder paddy farmers, the provision of WI or forecasts need to be accompanied by agronomic advice that is meaningful for farm management decision-making to help offset climate risks (Nkiaka *et al.*, 2019; Dilling and Lemos, 2011). WI is only useful in addressing the threats posed by climate change when they can be accessed in a form easily understood by smallholder paddy farmers (Muema *et al.*, 2018). However, the provision of WI often faces a host of technical and socio-

economic barriers, limiting its uptake and utilization for effective decision-making. Although a significant volume of climate change research has been published over the last three decades and decision-makers in fields such as agriculture, water management, disaster response and urban planning show eagerness to enhance their utilization of WI, a notable disparity remains between the generation of knowledge and its practical application (NRC, 2009).

A better understanding of how climate-forecasting technology might be more effectively integrated into farmers' decision-making processes is needed, not only to guide government investment and increase value to producers, but also to gain insights into the reasons behind the low adaption of adaptation strategies. Enhancing the capacity of resource-users to cope with and adapt to climate variability will encourage gradual, incremental adjustments for adapting to climate change adaptation (Marshall *et al.*, 2010).

However, in Sri Lanka, this process is not happening adequately. Many farmers lack access to timely and reliable WI, relevant training and adaptive technologies. As a result, their ability to make small, proactive changes in their practices over time is limited. This lack of adaptive capacity can have serious repercussions. Farmers are left vulnerable to sudden climate shocks such as droughts or floods, leading to significant crop losses, income instability and food insecurity. Without the skills and resources to adjust incrementally, their responses tend to be reactive rather than planned, often resulting in distress sales of assets, increased debt, or abandonment of farming altogether. In the long run, this undermines their resilience to climate change and hampers national goals of achieving sustainable and climate-resilient agriculture.

A review of previous research indicates that limited attention has been given to farmers cultivating paddy under rainfed and minor irrigation systems. Given the crucial role of WI in paddy cultivation, small-scale farmers in these systems form the primary group that needs to be considered. However, the lack of focused studies has restricted their adaptive capacity to manage climate risks, leaving them with minimal opportunities to respond effectively. For instance, Dissanayake and Thibbotuwawa (2018) conducted a study across six districts—Anuradhapura, Batticaloa, Hambantota, Kurunegala, Badulla and Rathnapura—with a sample of 900 farmers. Yet, their work did not specifically highlight paddy farmers in rainfed and minor irrigated areas, which are the central focus of the present study. Consequently, research directly addressing this group remains scarce. This study, therefore, aims to fill that important gap.

Empirical evidence on the opportunities associated with WI and the barriers to greater uptake of WI services by smallholder paddy farmers is still largely lacking in Sri Lanka. This gap hampers the adaptive capacity of smallholder paddy farmers to address climate risks. This research aims to explore whether and how smallholder paddy farmers in Sri Lanka use climate forecasts in making crop management decisions, whether such use would lead to benefits and to identify the opportunities and barriers to the uptake of WI by smallholder paddy farmers for building resilient agricultural systems.

This study attempted to address this gap by focusing on the following research questions.

- I. What weather information services or channels are available and accessible to smallholder paddy farmers for making agricultural management decisions?
- II. What is the current situation regarding access to and use of weather information by paddy farm households in the dry zone of Sri Lanka? What is the level of accessibility?
- III. To what extent is the received weather information being used?
- IV. What factors influence the successful access to and use of weather information by farm households for their livelihoods?

1.3 Research Objectives

The proposed research aimed to address the following key objectives:

- a. To identify weather information services and channels accessible to smallholder paddy farmers for making agricultural management decisions.
- b. To assess the level of access to and utilization of weather information among paddy farmers in rainfed and minor irrigated areas in the dry zone of Sri Lanka and the extent of weather information informs farmers' decision-making processes related to farming practices and adaptation strategies.
- c. To examine the factors that determine the access to and utilization of weather information by farmers.

1.4 Organization of the Research Report

The introductory chapter sets the stage for the report, providing essential background and context. Following this, the second chapter delves into an overview of WI and its relevance to crop farming. The third chapter outlines the research methodology employed in the study. The fourth chapter explores the available WI services and communication channels in crop farming. Subsequently, the fifth chapter examines the accessibility and utilization of WI among paddy farmers. Finally, the report concludes with a chapter dedicated to key findings, conclusions and policy recommendations, offering actionable insights based on the study findings.

CHAPTER TWO

An Overview of Weather Information Used in Paddy Farming

This literature review explores the existing body of research on farmer adherence to early forecast. Accordingly, chapter reviews the literature related to the research objectives specified in the previous chapter under three categories: existing WI services and channels available/exist for paddy farmers, access to and utilization of WI among paddy farmers in Sri Lanka and factors affecting to access to and utilization of WI by paddy farmers.

2.1 Paddy: As a Climate Sensitive Crop

Sri Lanka is mainly an agricultural nation, and approximately 25 percent of its workforce is engaged in farming occupations throughout the country (Department of Census and Statistics, 2025). Paddy cultivation is vital for the national food security of the country and plays a key role in maintaining economic stability. Moreover, it also serves as a major source of employment for a significant proportion of the population, mostly in rural regions. However, paddy farming is highly vulnerable to the effects of climate change. Research indicates that paddy farming is especially vulnerable to rising temperatures and increasingly variable rainfall patterns (Esham and Garforth, 2013 and Ratnayake *et al.*, 2023).

Paddy is grown as a seasonal crop, in *yala* and *maha* seasons. The *maha* season (October to March) usually accounts for about 65 percent of the total crop, while the remaining 35 percent is produced during the *yala* season (April to September). Both seasons are important for paddy cultivation, but climatic variations pose a significant threat to the ideal planting and harvesting (Ratnayake *et al.*, 2023). Sudden changes in climate during these seasons may cause tremendous losses in paddy yields.

As reported by (Amarasingha *et al.*, 2015), knowing the onset of rainfall through forecasts can facilitate the adjustment of planting dates based on the predicted rainfall and enable more efficient irrigation management —both of which are important for reducing risks in paddy farming. Based on their study, they also suggested that the timing of paddy seedling planting needs to be adjusted based on the prediction of the onset of seasonal rainfall to make use of the maximum available natural resources' potential. Similarly, Rivera *et al.*, (2018) state that adjustments in planting dates based on predicted rainfall can enhance yields and water productivity, highlighting the importance of timely WI.

As a climate sensitive crop, in major paddy growing areas where cascade systems are not available or functioning paddy farming is mainly depended as a rain fed cultivation. For farmers in those areas WI is crucial to get correct and timely farming decisions. Additionally, receipt of timely and accurate WI is another important factor. If not inaccurate or missing forecasts have been linked to yield losses in paddy farming (Dharmarathna *et al.*, 2014). Historical data reveal that incorrect synchronization with

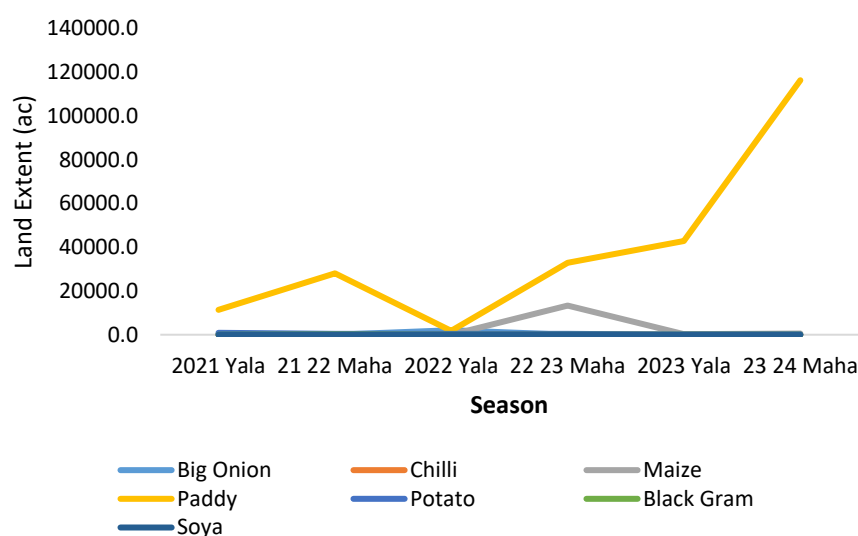
rainfall patterns can lead to drastic reductions in paddy output, underlining the need for quality forecasts (Munasingha and Napagoda, 2021). With an increase in climate variability, the requirement for reliable CIPs becomes essential for sustaining paddy output as well as ensuring food security in the region (Amarasingha *et al.*, 2015).

The increased frequency of crop failure induced by climate change in Sri Lanka has prompted the government to propose a comprehensive response through agricultural insurance and disaster relief interventions. Dependence on this type of financial support has been accelerated by the increased occurrence of climatic extremes such as floods and drought, which have significantly affected smallholder paddy farmers.

The Sri Lankan government has initiated a line of insurance programmes aimed at supporting agricultural producers, such as Crop Insurance Scheme of Agricultural and Agrarian Insurance Board. These programmes are designed to reduce the economic risks associated with climate change. For instance, weather index insurance has shown promise as a mechanism for safeguarding farmers from drought and research suggests that holistic approaches can significantly improve resilience (Amarnath *et al.*, 2023).

2.2 Climate related Crop Losses and Government Compensation Payments in Paddy Cultivation

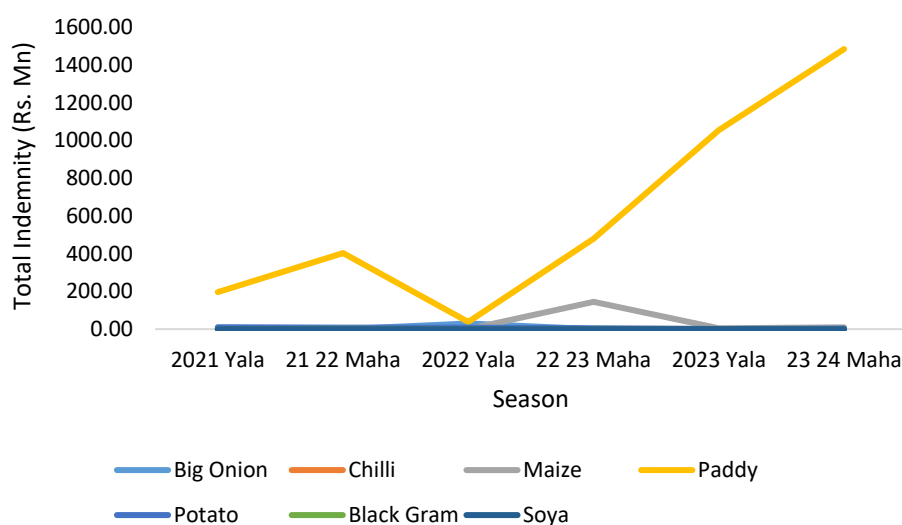
According to the Sri Lanka Agricultural Insurance Board, government compensation is currently provided to registered farmers who cultivate major other field crops such as big onion, chilli, maize, paddy, potato, black gram and soybean. Among these, paddy has emerged as the most vulnerable crop to climate-related risks, as evidenced by data on both cultivated land losses due to climate hazards and financial indemnity. Figure 2.1 shows the total land area affected by floods, droughts and erratic weather events between the 2021 *yala* and 2023/24 *maha* seasons. While losses were initially moderate, a significant increase is evident from the 2022 *yala* season onwards, culminating in a peak of over 116,000 acres in the 2023/24 *maha* season. This escalation signals not only the intensifying impacts of climate variability but also the limitations of existing agricultural systems to absorb such shocks.



Source: Agricultural and Agrarian Insurance Board Unpublished, 2021-2024.

Figure 2.1: Sum of Acres Indemnity (2021 Yala – 2023/2024 Maha) Crop Wise

This is further reflected in rising government compensation payments to affected farmers, as shown in Figure 2.2. Indemnity payments for paddy farmers followed a similar trend, with relatively low payouts in the earlier seasons and a sharp rise beginning in 2022 *yala*, peaking during the 2023/24 *maha* season. These increased payments coincide with periods of extreme rainfall and prolonged dry spells, confirming that climate anomalies are becoming more frequent and severe. The growing financial burden on state supported insurance schemes highlights the paddy sector's extreme exposure to climate risks and underscores the urgent need for more proactive adaptation strategies.



Source: Agricultural and Agrarian Insurance Board Unpublished, 2021-2024.

Figure 2.2: Sum of Total Indemnity (Rs.) (2021 Yala – 2023/2024 Maha) Crop Wise

The importance of paddy cultivation to Sri Lanka's food security, rural livelihoods and water-dependent cropping patterns justifies its selection as the focus of this study. As smallholder farmers dominate the paddy sector, the growing extent of land damage and rising compensation payouts due to climate change have far-reaching implications for national agricultural resilience. Despite the availability of technical and financial interventions, the behavioural dimension of adaptation — specifically, paddy farmers' use of early WI — remains insufficiently explored. The consistent rise in both affected acreage and public expenditure highlights the urgency of investigating how farmers engage with early forecasts and whether such engagement can reduce both spatial and economic vulnerabilities. This study seeks to address this critical gap by examining the extent of farmer adherence to climate forecasts in Sri Lanka's paddy sector as a pathway to improve climate resilience.

Sri Lanka has experienced increased government payments and compensation to paddy farmers for climatic-related disasters, particularly droughts and floods, in recent years. As indicated by Prasada (2020), the drought that hit the 2016-2017 season resulted in a drastic drop in paddy yields, thereby triggering the government to contemplate income-smoothing approaches, including compensation for the farmers adversely affected. Further, his report identified that farmers favoured climate-indexed insurance, with revenue-based compensation approaches gaining preference—indicating a shift toward more organized financial support structures.

The bi-seasonal cultivation structure (*maha* and *yala*) further underscores the importance of accurate seasonal forecasts for effective paddy farming. Compared to other agrarian products, even minimal variations in climatic conditions can cause substantial reduction in paddy yields (Rivera *et al.*, 2018), reinforcing the need to assess paddy farmers' adherence to early forecasts for building climate resilience.

2.3 Existing Weather Information Services and Channels Available for Paddy Farmers

While many agricultural development projects conduct research to understand the informational needs of their target farmers and establish various WI services and communication channels, concerns remain regarding the actual availability of these channels to smallholder paddy farmers for making informed agricultural management decisions. This section aims to examine the available WI services and communication mechanisms accessible to smallholder paddy farmers, focusing on both the Sri Lankan context and a broader global perspective.

In the context of Sri Lanka, there is limited evidence regarding the channels used to disseminate climate-related agricultural information to smallholder paddy farmers. However, findings from a study on mobile-based communication among farmers indicate that a considerable proportion of them utilized mobile phones to engage with input suppliers, buyers, agricultural extension officers and fellow farmers. These communication channels also served as one of the key means for accessing climate-related information (Dissanayake and Wanigasundera, 2014).

The DoM serves as the nationally designated CIP in Sri Lanka. The DoM delivers climate-related information on a daily, weekly, monthly and seasonal basis. Further, it issues warnings and advisories regarding adverse weather conditions including heavy rainfall, lightning, high winds and cyclones, enabling smallholder paddy farmers to make informed agricultural management decisions. The DoM operates a nation-wide network of meteorological stations and collaborates with other agencies in sectors such as agriculture, plantations and irrigation to maintain a significant number of agro-meteorological units.

Lokanathan and Kapugama (2012) identified that smallholder paddy farmers in Bangladesh, India, Sri Lanka and Thailand primarily rely on several sources for information. These include their own knowledge, family and friends, government extension services, input suppliers, traders and collectors, as well as mass media platforms. Globally, there is a growing recognition of the importance of understanding how people access WI services and the effectiveness of different communication mechanisms.

Thibbotuwawa (2018) explained that climate uncertainty has emerged as a significant economic challenge in Sri Lanka. While the impacts of extreme climate events affect the entire population, the farming community— particularly dependent on climate conditions for its livelihood — faces more severe consequences. Farmers experience economic losses due to frequent floods, storms and droughts, as well as the gradual effects of climate change, including rising temperatures and unpredictable changes in established rainfall patterns. Further, Senaratne (2018a) suggested that the relative importance of different media channels, such as TV, radio, newspapers and the internet, varies depending on the type of CIP. The study indicated that electronic media, particularly TV, radio and the internet, attract the most attention for disseminating WI.

Dissanayake and Thibbotuwawa (2018) noted that Sri Lankan farmers utilize both traditional and modern sources to obtain WI. These sources include weather reports from TV, radio and newspapers as well as *pre-season* meetings, expert advice from Agriculture Instructors (AIs) and Agricultural Production and Research Assistants (ARPAs), the experiences of other farmers and local observations. Further, Senaratne (2018a) emphasized that, in the Sri Lankan context, CIPs are frequently delivered through public media channels, including TV, radio, newspapers and the internet. His research suggests that the significance of these media varies depending on the type of CIP. Furthermore, the study revealed that electronic media, such as TV, radio and the internet are the most attention from farmers as sources of WI.

Elly and Silayo (2013) reported that rural farmers in the Iringa district of Tanzania access agricultural information through various channels, prioritized according to their preferences. These include inter-personal communication, social gatherings, farmer groups or associations, village or local leaders, mobile phones, input suppliers or agro-dealers, extension officers, radios, public address systems, agricultural exhibitions, village signboards and non-governmental organizations (NGOs). Caine *et al.*, (2015)

highlighted that WI is predominantly provided by national meteorological agencies. Furthermore, evidence indicates that in Africa, certain private companies have begun offering weather predictions as part of mAgri projects. These projects primarily focus on delivering short-term weather forecasts; however, a few initiatives also provide medium-range and seasonal forecasts.

According to Kughur, Dudce and Akua (2014), agricultural information is typically disseminated through a variety of channels. These include mass media platforms such as radio broadcasts and print media, as well as traditional media. Further, interpersonal communication methods, including face-to-face interactions, group discussions and demonstrations, play a significant role in the dissemination process.

2.4 Access to and Utilization of Weather Information among Paddy Farmers in Sri Lanka

Access to and utilization of WI play a pivotal role in shaping the decision-making processes of farming households, particularly in vulnerable regions such as the dry zone of Sri Lanka. Paddy farmers in this area face significant challenges due to changing climatic conditions, including erratic rainfall patterns, prolonged droughts and temperature fluctuations. The availability of timely and accurate WI has the potential to enhance their capacity to adapt by guiding farming practices and informing adaptation strategies. However, the extent to which such information is accessed, understood and effectively used by these smallholder paddy farmers remains a critical concern. Understanding this dynamic is essential for identifying gaps in knowledge dissemination, barriers to utilization and opportunities to strengthen adaptive capacities in the face of ongoing climate challenges and in preparation for future global climate change impacts.

In addition, Senaratne (2018a) reported that the DoM recently launched the "Monsoon Forum," which aims to provide seasonal climate outlooks with a lead time of three to six months, covering the two monsoon periods—the South-West and North-East monsoons. This forum primarily focuses on paddy cultivation by smallholder paddy farmers, particularly those using minor irrigation systems and rain-fed irrigation methods. The Monsoon Forum brings together participants from various state agencies responsible for agriculture, plantations, irrigation and water management, disaster management and defense.

Agriculture sector officials, such as AIs and ARPAs, who directly engage with smallholder paddy farmers at the grassroots level, are actively involved in the forum. The major information products offered by the Monsoon Forum include: (i) an overall forecast of total rainfall for a given monsoon season, classified into three climatological probability categories—below normal, normal and above normal; and (ii) experimental monthly rainfall forecasts, providing average rainfall in millimeters $\pm$ 10% for all districts, also categorized under the same three climatological probability levels. Extension officers are responsible for disseminating these forecasts to farmers.

Although research on the actual use of available CIPs is limited, Senaratne (2018a) reported the findings from a survey conducted by the Institute of Policy Studies (IPS) among smallholder paddy farmers in the Anuradhapura district, who rely on water from minor irrigation schemes (village tanks). The survey revealed that 73 percent of farmers regularly seek daily weather reports through public media. However, only 2.8 percent of farmers identified media weather reports as their primary source of information, a figure significantly lower than those who considered personal judgment and observations (87%) or interactions with fellow farmers (8.8%) as their main sources.

Similarly, Hirimuthugodage (2018) found that farmers primarily rely on their climate-related decisions on personal observations and expectations, with these decisions further influenced by peer interactions. While many farmers access WI through media channels, their assessment of the media's usefulness in actual farming decisions remains low.

Senaratne (2018b) examined farmers' beliefs regarding local climate indicators, which are based on observations of changes in the local environment. These observations are interpreted as signs of impending climatic events, such as rainfall, forming a local forecasting system where different indicators provide varying lead times for anticipated events. Such indicators include wind patterns, sky and cloud observations, local hydrological events (e.g. tank overflow timing), thermal changes, cosmological observations, the resurgence of indicator species and the behaviour of animals and local fauna. Interviews and discussions with farmers confirmed that they continue to rely on these local beliefs for regular decision-making related to farming and other daily activities. However, the majority of farmers (89%) expressed concerns that changing rainfall patterns could reduce the reliability of local forecasts over time. The study also found that farmers tend to give more attention to media sources during extreme weather events such as heavy rainfall, floods, cyclones and tropical storms.

Further, Senaratne (2018a) suggests that in Sri Lanka, TV is the most effective medium for communicating WI, followed by radio. Several TV and radio channels in the country provide daily weather reports at the conclusion of regular news bulletins, based on forecasts from the DoM. Additionally, both TV and radio channels highlight WI as key news items during special events, such as extreme weather occurrences. Panabokke and Punyawardena (2010) stated that farmers in village tank systems and minor irrigation systems in the dry zone of Sri Lanka rely heavily on local rainfall for their livelihoods.

Hirimuthugodage (2018) reported that farmers who participated in Participatory Rural Appraisal (PRA) programmes use local environmental observations, such as animal behaviour, the blossoming of certain indigenous trees, the appearance of various insects and changes in cloud patterns and wind, to guide their agricultural decisions. These practices however, can vary across different regions within Sri Lanka. Farmers also noted that due to recent global climate changes and alterations in local environments, the reliability of their traditional predictions has decreased. They

mentioned that, in the past, their predictions based on traditional knowledge were generally accurate, but the situation has changed in recent times. Therefore, it is evident that farmers may no longer be able to rely solely on their traditional knowledge, as local climate patterns and environmental conditions have shifted, making some traditional indicators less practical today.

Senaratne (2018b) highlighted that WI such as inter-annual variability, timing and amount of precipitation, plays a critical role in agricultural decision-making. Despite the availability of scientific weather forecasts, local farmers continue to rely more on indigenous knowledge. Rural communities observe the behaviour and activities of domestic and wild animals, insects and various plant species to predict weather and seasonal changes in their environment. They depend on specific indicators to forecast upcoming weather and climate conditions. For example, changes in animal behaviour, the appearance of certain animals, sudden increases in insect populations, bird nesting behaviours and the migration patterns of certain species are traditional climate indicators used by Sri Lankan farmers.

Studies by Hansen, Marx and Weber (2004) emphasized that farmers' expectations of rainfall significantly influence their decisions regarding adaptation to climate change. Additionally, Orlove *et al.*, (2010) provided substantial evidence that smallholder paddy farmers' rainfall expectations are shaped by 'shared beliefs' about local rainfall patterns.

2.5 Factors Affecting to Successful Access to and Utilization of Weather Information by Paddy Farmers

Access and use of WI among smallholder farmers are highly influenced by interconnected socio-economic factors, such as education, income and gender. These variables play a crucial role in determining farmers' capacity to interpret and respond to climate-related information, thereby shaping their decision-making strategies. Senaratne (2018a) identified several factors that influence the successful access to and utilization of climate change information by smallholder paddy farmers. These factors include farmers' beliefs and perceptions, traditional knowledge, WI needs and communication gaps, which encompass aspects such as the format and content of information, availability and access to information and preferred delivery mechanisms. Additionally, the study highlights the importance of Integrated Climate Information Management Systems (ICIMS), technological challenges, capacity building and policy and institutional support in facilitating effective WI dissemination and use.

Higher education broadens farmers' capacity to understand and use climate forecasts effectively, thereby enhancing their decision-making and adaptability skills through greater access to internet-based WI (Henriksson *et al.*, 2021; Gouroubera *et al.*, 2024). Nyoni *et al.* (2024) and Myeni *et al.* (2024) stated that the income of farmers is a significant factor influencing farmers' access to technological resources such as mobile phones, radios and internet connectivity.

More affluent farmers are more likely to acquire timely WI, while poorer farmers face barriers in adjusting to climate variability. Gender dynamics also significantly affect access to WI, with women often excluded from decision-making in agriculture and information sharing. Women tend to rely on alternative sources, such as knowledge brokers, highlighting the need for gender-sensitive approaches in WI dissemination (Henriksson *et al.*, 2021 and Gouroubera *et al.*, 2024).

Additionally, women's low levels of education and limited access to resources make it difficult for them to utilize WI effectively (Ruth *et al.*, 2020). Access to infrastructure, including communication networks and extension services, plays a pivotal role in delivering timely and relevant information. Social networks and community institutions further facilitate knowledge sharing and collective action. Additionally, the perceived reliability of information sources and the alignment of data with local needs and contexts significantly impact its adoption. Addressing these factors is crucial for enhancing farm household resilience and ensuring the sustainability of their livelihoods amidst climate challenges.

Recio *et al.*, (2003) noted that farming practices involve complex decision-making processes, characterized by significant uncertainty and multiple possible courses of action. This is particularly true for paddy farming in the dry zone of Sri Lanka, where making timely and accurate farming decisions is a significant challenge. The study by Mahindaratne and Min (2019) found that information related to crop protection, marketing and climate were the primary information needs of smallholder paddy farmers.

Limited empirical evidence exists regarding the factors that influence individual farmers' adaptation decisions in response to WI, particularly in the context of crop farming (Vincent, 2007). While many studies aim to provide broadly applicable guidelines, they often offer only limited insights into local-level adaptation processes, especially concerning the adaptation strategies of small-scale farmers. Smit and Pilifosova (2003) proposed five key factors that determine the adaptive capacity of communities or regions: economic wealth, technology, information and skills, infrastructure and institutions and equity. Building on this framework, Yohe and Tol (2002) expanded the concept by identifying eight major determinants of adaptive capacity: (i) the availability of technological options for adaptation; (ii) the availability and equitable distribution of resources across the population; (iii) the structure of critical institutions, including decision-making authority and criteria; (iv) the stock of human capital, encompassing education and personal security; (v) the stock of social capital, including the definition of property rights; (vi) access to risk-spreading mechanisms; (vii) the ability of decision-makers to manage information and assess its credibility, as well as their own credibility; and (viii) the public's perception of the source of stress and its exposure to local manifestations.

In a global context, Antwi-Agyei (2014) found that households adopt a variety of on- and off-farm adaptation strategies to cope with climate variability. These strategies include adjusting planting times, using early-maturing crop varieties, diversifying

crops, seeking support from family and friends and altering dietary habits. The study further suggests that many households rely on adaptation strategies that involve livelihood diversification to cope with the increasing climate variability observed in recent decades. Consequently, a significant number of households now engage in multiple non-agricultural livelihood activities as a means to mitigate the risks of crop failure due to climate variability.

CHAPTER THREE

Methodology

The research employed a mixed-methods approach, combining surveys, key informant interviews and field observations. Data were collected from diverse geographical locations and a range of stakeholders, including farmers and officials to ensure a comprehensive understanding of the issues.

3.1 Study Locations and Sample

Paddy farmers were selected as the sample population based on several key considerations. Firstly, paddy cultivation is a predominant agricultural activity in Sri Lanka, practiced widely across all districts of the country. Additionally, the well-established organizational and institutional frameworks within the agricultural sector support the dissemination of information and training to paddy farmers. Secondly, paddy production in Sri Lanka takes place under three distinct water management systems: major irrigation, minor irrigation and rain-fed production. These systems exhibit significant heterogeneity, including socio-economic conditions and water availability for cultivation. Major irrigation systems, such as the Mahaweli systems, typically provide farmers with sufficient water for both seasons compared to other systems. Conversely, minor irrigation and rain-fed systems are more vulnerable to water stress and climate change-related hazards.

Given the importance of water management and the integration of WI into cultivation decisions, particularly within these vulnerable systems, this study focuses on farmers operating under minor irrigation and rain-fed conditions. Moreover, within these systems, farmers in the dry zone are disproportionately affected by climate-related risks, making them a priority population for this study. Districts were selected to collectively cover 50 percent of the total land area under paddy cultivation.

The Cochran formula is used to calculate sample size based on a desired level of precision, desired confidence level and the estimated proportion of the attribute present in the population (Piran-Qeydari, Heidarabadi, and Farzaneh, 2022). It is considered appropriate especially in situations with large populations. For the present study, it was decided to keep the margin of error and confidence level as 5% and 95% respectively. According to the Cochran multistage stratified sampling technique, the calculated sample size for the study was 384 and to avoid outliers, 445 farmers were interviewed. Then the number of farmers coming under each irrigation system was determined proportionately to the total land extent cultivated under each irrigation system considering all paddy cultivating districts in the country. Agrarian Services Centres (ASCs) from each selected district were selected with the highest land extent of paddy cultivated ASCs under each irrigation systems in each district.

At the field level, the sample was proportionately distributed among representative ASCs under each irrigation system randomly and selected randomly. The selected

districts and the number of sample farmers from each district are presented in Table 3.1 and Appendix A.

Table 3.1: Sample Distribution

District	Irrigation System		Total
	Minor	Rainfed	
Batticaloa	-	80	80
Kurunegala	77	57	134
Ampara	-	44	44
Anuradhapura	103	44	147
Vavuniya	40	-	40
Total	220	225	445

3.2 Data Collection Methods

Both primary and secondary data were collected for the study. Primary data were obtained through a questionnaire-based survey of farmers conducted via direct interviews. This process was further enhanced using the Computer-Assisted Personal Interviews (CAPI) method, implemented through the KOBO toolbox. A semi-structured questionnaire was utilized to gather information on various aspects, including socio-demographic characteristics, WI services and channels, accessibility and utilization of WI in farming decisions and the dissemination of information through institutional setups.

Key Informant Interviews (KIIs) were also conducted with government officials, such as Agriculture Instructors (AIs), Agrarian Development Officers (ADOs) and Agriculture Research and Production Assistants (ARPAs) in each ASC to understand the mechanisms of WI dissemination from a government perspective. Secondary data were sourced from published reports, online resources, and publications of government institutions, including the Natural Resource Management Centre (NRMC) the Department of Agriculture and the Department of Meteorology.

3.3 Data Analysis

Previous studies have used descriptive methods for analyzing the status of access and use of climate change information (Carr *et al.*, 2020; Chukwuji *et al.*, 2019) and often applying regression models to identify and examine the factors influencing that access and use. Probit and Logit Models are the most relevant for this type of study due to the dichotomous nature of the dependent variable (Muema *et al.*, 2018). A logistic regression model was chosen over alternatives such as discriminant analysis model as its advantage in mathematical simplicity and ability to yield meaningful results. Logistic regression does not require assumptions of normality in the independent variables and equal variance within each group in logistic regression. However, discriminant analysis can only be used with continuous independent variables keeping the assumptions of normality and equal variance (Peng, Lee and Ingersoll, 2002).

The logit models utilized in behavioural studies are based on the Maximum Likelihood theory proposed by Ben-Akiva and Lerman (1985) (Esayas and Gecho, 2017). These models are divided into two main types: binary and multinomial logit models. According to Tabachnick, Fidell and Osterlind (2001), multinomial logistic regression offers several notable advantages over other regression models. This technique is commonly used to predict categorical placement or the probability of a specific category of use of a dependent variable based on multiple independent variables. Like binary logistic regression, multinomial logistic regression employs maximum likelihood estimation to determine the probability of a particular outcome level.

To determine the factors that predict the level of WI use among smallholder paddy farmers in the context of climate change, a multinomial logistic regression model was applied to the survey responses. This model was used to predict the probabilities of the different possible outcomes. Multinomial logistic regression is suitable for predicting categorical outcomes or the likelihood of membership in a particular category of a dependent variable, based on multiple independent variables. As in binary logistic regression, multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership. Thus, this type of model allows for the characterization of a respondent's decision for a particular multinomial discrete choice, conditional on the values of the explanatory variables (Clark *et al.*, 2019). Since the distribution functions of explanatory variables are often non-linear, once the model is fitted, its parameters are used to estimate the probability of an outcome occurring relative to a reference category.

This study aimed to examine how changes in the following independent variables ($X_1, X_2, \dots, X_k$) including the socio-economic, demographic variables of the principal farmer and influence the probabilities of the dependent variables Y -(utilization of WI and accessibility of WI) in Equation (1) expressed as follows:

$$P(Y=j/X_1, X_2, \dots, X_k) = P(Y=j/K); j=0, 1, \dots, J \quad (1)$$

In the multinomial case, response probabilities were represented in Equations (2) and (3) as follows:

$$P(Y = j / X) = \frac{\exp(X\beta_j)}{1 + \sum_{h=1}^J \exp(X\beta_h)} = p_j(X, \beta); j = 1, \dots, J \quad (2)$$

$$P(Y = 0 / X) = \frac{1}{1 + \sum_{h=1}^J \exp(X\beta_h)} = p_0(X, \beta) \quad (3)$$

Study used maximum likelihood to estimate multinomial logit models in which the logarithm of the likelihood function that usually provides consistent and asymptotically normal estimators is expressed by Equation (4) as follows:

$$J(\beta) = \sum_{i=1}^n \sum_{j=0}^J 1[Y_i = j] \log[p_j(X_i, \beta)] \quad (4)$$

Further, data were analyzed using both inferential statistics and descriptive statistical methods, as appropriate, to address each research objective. Descriptive analysis was employed to provide a clear and concise summary of the collected data, facilitating interpretation of results in alignment with the objectives of the study.

CHAPTER FOUR

Weather Information Services, Channels Used in Crop Farming

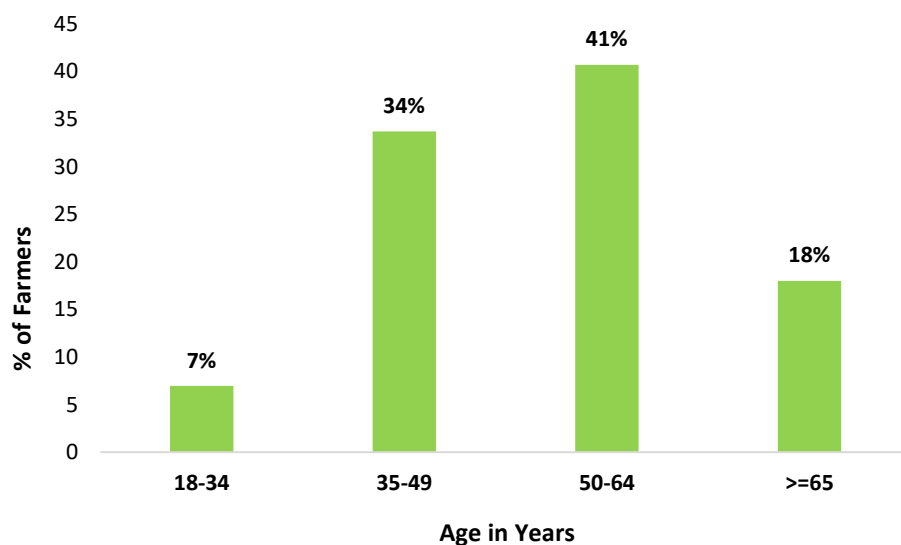
4.1 Introduction

WI plays a crucial role in crop farming, enabling farmers to make informed decisions to enhance productivity and resilience to climate variability. It encompasses tools, resources and communication channels that deliver timely and relevant weather and climate data to farmers. These services, facilitated through institutional setups and digital platforms offer forecasts, advisories and early warnings that are critical for planning agricultural activities such as sowing, irrigation pest management and harvesting. Understanding the current status of these services, along with the effectiveness of their dissemination channels, is essential to identify gaps, improve accessibility and optimize their utilization by farmers.

Hence, this chapter provides a detailed account of the socio-demographic characteristics of the sample, existing mechanisms for the dissemination WI, channels and services through which WI is delivered, and the service providers involved in its dissemination. The period from 01st August 2023 to 31st July 2024 was considered as the reference period.

4.2 Socio-Demographic Characteristics of the Sample

4.2.1 Age Distribution of Principal Farmer



Source: HARTI Survey Data, 2024.

Figure 4.1: Percentage Distribution of Farmers by Age

4.2.2 Educational Attainment of the Principal Farmer

Table 4.1: Distribution of Principal Farmers by Educational Attainment of (Frequency and Percentage)

Level of Education	Frequency	Percentage of Farmers
No Formal Education	9	2
Primary (Grades 1-5)	60	13
Secondary (Grades 6 -11)	203	46
G.C.E. O/L Passed	82	18
Up to G.C.E. A/L	16	4
G.C.E. A/L Passed	69	16
Tertiary Education	6	1
Total	445	100

Source: HARTI Survey Data, 2024.

According to Table 4.1, the majority of farmers in the sample have attained a secondary education level (46%). Further, 18 percent of farmers have passed the G.C.E. O/L examination, while 16 percent have passed the G.C.E. A/L examination. Furthermore, 13 percent of farmers have only completed primary education (Grades 1 to 5). Notably, two percent of farmers have no formal educational background. Overall, the data indicates a relatively low level of education among paddy farmers in the sample.

4.2.3 Primary Employment of the Principal Farmer

Farmers are engaged in various types of employment to sustain their livelihoods. However, the majority (74%) primarily rely on crop farming as their primary employment. Government employment ranks second, accounting for 14 percent, followed by self-employment in third place (3%). These results clearly demonstrate that the sample provides a strong representation of the farming community (Table 4.2). These findings clearly indicate that the selected sample accurately represents the farming community in the country.

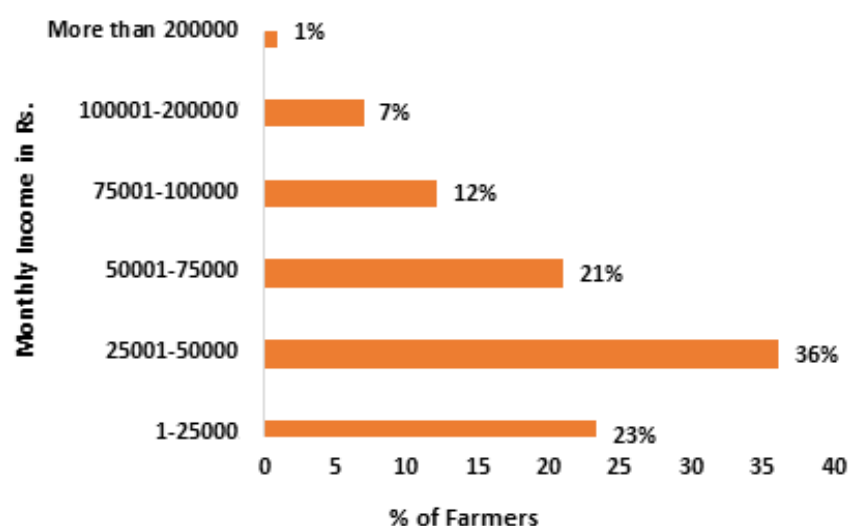
Table 4.2: Information on Primary Employment of Principal Farmer

Types of Employment	Frequency	Percentage of Farmers
Crop farming	328	74
Self-employed	14	3
Non-agricultural labour (non-skilled)	13	3
Government employment	63	14
Social security funds (<i>Samurdhi</i> , farmer pension etc.)	1	0.2
Skilled labour (carpenter, mechanic etc.)	10	2
Private sector employment	5	1
Animal husbandry	4	1
Agricultural labour (non-skilled)	6	1
Monthly allowance from relatives	1	0.2
Total	445	100.00

Source: HARTI Survey Data, 2024.

4.2.4 Distribution of Monthly Income of Principal Farmer

The average monthly income of the principal farmers in the sample is Rs. 54,430. The majority of farmers (36%) fall within the income range of Rs. 25,001– Rs. 50,000 per month. Additionally, 23 percent of farmers belong to the lowest income category, earning less than Rs. 25,000 monthly (Figure 4.2). Notably, only one percent of farmers reported a monthly income exceeding Rs. 200,000. Furthermore, 64 percent of farmers in the sample had a secondary source of income to support their families in addition to their main employment. These findings underscore the significant variation in income levels within the farming community.



Source: HARTI Survey Data, 2024.

Figure 4.2: Percentage Distribution of Farmers by Monthly Income

The Pearson Correlation Analysis between total income (summation of main income-income that receives highest money to the family and secondary income - second income that receives highest money followed by main income) and main income of the farmers shows a positive correlation ($r = 0.778$; $p < 0.05$). This indicates a strong positive correlation, suggesting that as the main income increases, the total household income also tends to increase significantly.

Additionally, the Pearson correlation between total income and secondary income ($r = 0.742$; $p < 0.05$) indicating a strong and statistically significant positive relationship. This implies that higher secondary income is strongly associated with higher total household income, highlighting the substantial contribution of secondary income to overall household earnings. In contrast, the correlation between main income and secondary income is $r = 0.157$; $p < 0.05$. Although this relationship is statistically significant, the correlation is weak, suggesting that the main and secondary income sources are relatively independent of each other. This implies that the two income sources are largely independent—earning more from the main income source does not necessarily correlate with earning more from secondary sources.

4.2.5 Other Information about Principal Farmers in Sample

The average household size in the study sample is four members. Household size ranged from a minimum of one member to a maximum of nine members. As shown in Appendix B, 57 percent of farm families consist of 4 to 6 members, while 97 percent of families have fewer than six members. This indicates a trend towards nuclear family structures.

Regarding household participation in agricultural activities, 82 percent of families reported the involvement of a single adult male, while 15 percent had two adult males engaged in farming. Female participation in agricultural activities stands at 63 percent (N=282). Among these, 81 percent of farm families have a single adult female engaged in agricultural work. Children's participation in farming activities is comparatively low. Only 12 percent of families (N=54) reported children's involvement in agricultural activities. Among these families, 54 percent had only one child participating in farming activities.

According to Appendix 4.1, 78 percent of farmers are engaged in agriculture on a full-time basis, while the remaining farmers practice it part-time. When considering the share of income derived from agriculture relative to the total family income, more than half of the sample (52 percent) reported that agriculture contributes over 60 percent to their total income, with an average share of 67 percent. Among these, 75 percent of farmers indicated that agriculture accounts for more than 80 percent of their total family income. Conversely, only 7 percent of farmers reported a lower contribution from agriculture to their family income.

The majority of farmers possess substantial farming experience, with 60 percent having over 20 years, 33 percent over 30 years, and a notable 11 percent with more than 40 years of experience. The average farming experience across the sample is 24 years.

4.3 Existing Mechanism of Disseminating WI

Of the total sample, 99 percent of farmers are reported to be aware of the existing mechanisms for the dissemination of WI within the country. In addition to that, it has been observed that approximately 69 percent of farmers stated that various WI dissemination projects and programmes are being implemented in their respective areas. Among these, the *Wewgam Pubuduwa* initiative is cited by a majority (56 percent) as actively operational in their communities. Similarly, the Climate Smart Agriculture Project (CSIAP) is mentioned by 46 percent of farmers as being implemented in their regions.

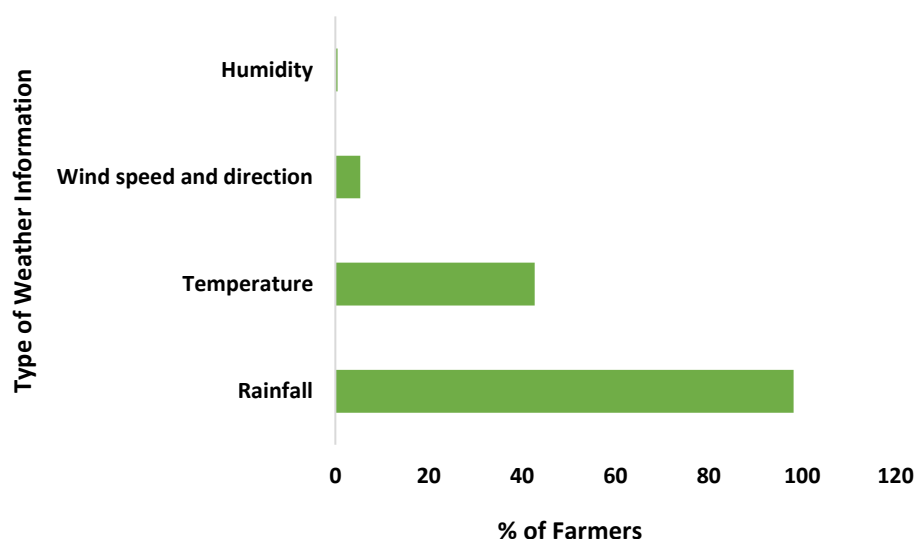
The aforementioned findings highlight those significant projects and programmes have been made to introduce and expand WI systems to rural agricultural areas. The widespread recognition of *Wewgam Pubuduwa* and CSIAP highlights their prominence and accessibility among farming communities, serving as vital tools for equipping

farmers with the knowledge to mitigate and adapt to climate-related challenges. As reported by the key informants in Anuradhapura, climate awareness programmes were conducted in Horowpathana ASC through these projects and WI was disseminated via WhatsApp groups created for this purpose. Through the *Wewgam Pubuduwa* initiative, WI was shared with paddy farmers in Horowpathana, Yakalla, and Palugaswewa ASC areas in Anuradhapura district and Galgamuwa and Ehatuwewa ASC areas in Kurunegala district via a WhatsApp group. However, in the Ehatuwewa ASC area, although WI was shared through this WhatsApp group, it was not known to the sample farmer households and therefore they were not utilized in making crop farming decisions due to not reaching those sample farmers.

Further, the Palugaswewa area was chosen as a demonstration center for this initiative. However, it was reported by these officials that the monitoring and supervision of project activities were not carried out properly and emphasized that the dissemination of WI is not yet sustainable. According to farmer households in the Kanagarayankulam region of Vavuniya district, as well as the Vantharumoolai, Karadiyanaru, and Eravur ASCs in Batticaloa district and Komari ASC in Ampara district —where the CSIAP project was implemented —activities such as tank rehabilitation, channel construction, maintenance of agricultural roads, supply of inputs and provision of marketing facilities for their products were carried out under this project. This finding implies that the projects or programmes facilitating the dissemination of WI may be more effective at providing rainfall-related data than temperature-related information. Clearly, regular monitoring of dissemination efforts and incorporating farmer feedback could further enhance the effectiveness of these programmes.

4.4 Weather Information, Weather Information Dissemination Channels and Services

The results of the Figure 4.3 show that rainfall information was by far the most commonly accessed WI during 2024 *yala*, with 98 percent of farmers relying on it. Temperature was the next most used, though at a much lower level (43% of farmers). Only a small proportion of farmers accessed information on wind speed and direction (5% of farmers) while humidity was rarely considered with just 0.46% of farmers using it. This indicates that rainfall and to a lesser extent, temperature are the most important WI needs for farmers, while other parameters are largely overlooked.



Source: HARTI Survey Data, 2024.

Figure 4.3 Type of Weather Information Received during 2024 yala

Table 4.4 presents the distribution of farmers based on the sources of WI they receive. A significant majority (78%) of farmers rely on TV for climate-related updates. This underscores the widespread reach and accessibility of TV as an information dissemination source among paddy farmers in these areas. As noted by Kughur, Dudce and Akua (2014), electronic media, particularly radio was identified as one of the most common methods for disseminating information in rural areas due to its affordability and portability, with the majority of the sample (56%) receiving information through this medium. However, in the study sample, only around 23 percent of paddy farmers were reported receiving WI via radio, which is less than half of the proportion observed in the study by Kughur, Dudce and Akua (2014).

About 60 percent of farmers utilize extension services, which typically involve direct interaction with AIs. This finding implies a notable reliance on formal agricultural advisory systems as a conventional source of WI, though it also suggests potential gaps in coverage or accessibility compared to TV. Only 41 percent of farmers obtain WI through farmer organizations (verbal communication from farmer to farmer), which play a vital role in community-based learning and peer exchange, particularly among paddy farmers. Among traditional sources, it was noted that 51 percent of respondents received this information through contact farmers (Kughur, Dudce and Akua 2014).

Field observations in the Batticaloa and Ampara districts that revealed some farmers, though registered in the respective ASC as rain-fed farmers, had farmlands near small tanks and utilized water from these sources. As a result, they attended the *pre-season meetings* held in the areas where the small tanks were located. WI was conveyed by some farmer organization leaders who participated in the meetings and farming activities (durations of land preparation, variety to be grown in the particular season,

broadcasting/transplanting and harvesting) were carried out based on the outcomes of these discussions, supporting the results obtained in this study.

Further, statistical analysis revealed significant associations between the channels or services through which WI was received and the socio-demographic characteristics of the principal farmer—specifically their age [χ^2 (21, N=445) = 48.89, $p < 0.05$] and gender [χ^2 (07, N=445) = 25.00, $p < 0.05$]. This implies that farmers access WI is influenced by these individual attributes, with certain groups having better access to or preferences for specific dissemination methods. Among the respondent farmers, the highest proportion of those who received WI via TV were aged 50–64 years (41%). The 50–64 age group also most frequently used radio to receive WI, while the 35–49 age group reported the highest use of mobile apps for WI, with 44 percent in this category utilizing them. Across all channels and services presented in Table 4.3, the majority of WI recipients were male farmers (76%) while female farmers (24%) accounted for a smaller proportion of the sample.

Table 4.3: Distribution of Farmers based on Dissemination Channels and Services of WI

Service/Channel	Frequency	Percentage of Farmers	Service/Channel	Frequency	Percentage of Farmers
TV	345	78	Mobile Apps	77	17
Radio	104	23	Text messages/Voice Messages/WhatsApp messages	97	22
Farmer organizations	183	41	Other (printed media, websites and workshops)	19	4
Extension services	264	60			

Note: The sum of the percentages of farmers exceeds 100 due to multiple sources were used to receive WI.
Source: HARTI Survey Data, 2024.

As noted by Kughur, Dudce and Akua (2014), WI is often relayed to other farmers through contact farmers. One significant aspect of this process is that contact farmers typically local villagers, better understands the needs of their fellow farmers than extension agent and at times, conveys the information to their peers more effectively than the extension agent does. Similarly, Lokanathan and Kapugama (2012) observed that smallholder paddy farmers in Bangladesh, India, Sri Lanka and Thailand primarily rely on multiple information sources, including self-acquired knowledge, family and friends, government extension workers, input suppliers, traders and collectors as well as mass media. Around, 39 percent adoption indicates a moderate uptake of mobile technology —such as mobile apps, text messages, voice messages and WhatsApp messages — by farmers, suggesting that nearly four in ten farmers are leveraging digital tools for information. The use of mobile apps, text messages, voice messages and WhatsApp messages suggest that digital communication channels reflect their

reach, particularly in areas with adequate mobile network coverage. However, since mobile apps require stable internet connectivity, farmers in rural parts of the study districts with limited or unstable access tend to rely more on text and voice messages, which can function offline or with minimal data usage.

During the KIIs conducted in Batticaloa (Kiran and Vantharumoolai ASCs) and Ampara (Panama ASC), it was found that some farmers in these areas had accessed a mobile app called S.E.E.D HUB, introduced through a project implemented by the Hector Kobbekaduwa Agrarian Research and Training Institute. This mobile app provided WI including rainfall, temperature, wind speed and wind direction for a 10-day period based on the location. However, it was noted that updates were not regularly available on the app and none of the sample farmer households reported actively using the app. Furthermore, mobile apps are most widely used in Anuradhapura (42%), showing strong adoption compared to other districts. In contrast, Ampara and Vavuniya have the lowest use (10%) indicating limited reliance on mobile apps, possibly due to weaker digital infrastructure or preference for traditional channels. Batticaloa (21%) and Kurunegala (17%) show moderate adoption reflecting some integration of mobile apps but not as strong as Anuradhapura.

The strong reliance on TV highlights the importance of leveraging this medium more effectively for prompt WI dissemination on time. However, the comparatively lower utilization of extension services and farmer organizations suggests an opportunity to strengthen these networks as conventional sources for more localized, interactive and detailed climate advisories. A multi-channel approach could thus enhance the reach and impact of WI on farming practices. Currently, farmers primarily receive WI through TV followed by extension services, farmer organizations and digital platforms. Batticaloa relies heavily on radio and farmer organizations showing the importance of community and traditional communication. Kurunegala and Ampara depend strongly on TV and extension services, but have low digital adoption compared to other districts. Across all districts, TV, extension services and farmer organizations remain important, but digital adoption varies widely.

Specifically, 59 percent of farmers regularly access TV for WI, while 34 percent use extension services and 30 percent utilize digital platforms. Statistical analysis further revealed a significant association between the channels or services farmers regularly access to obtain WI and their engagement in agriculture (full time or part time) [χ^2 (7, N=445) = 21.72, $p < 0.05$]. Full-time paddy farmers reported using a wider range of services and channels compared to part-time paddy farmers, with 91 percent of full-time farmers regularly accessing WI via text messages, voice messages or WhatsApp.

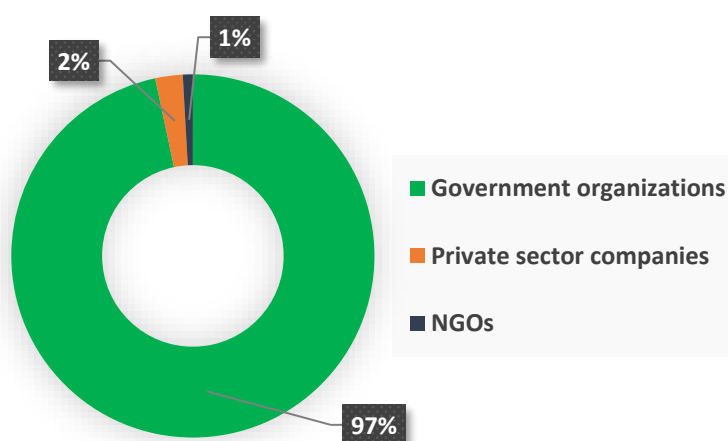
Further descriptive analysis reveals that farmers in Anuradhapura district regularly accessed WI through a diverse mix of channels, particularly TV (32%), extension services (30%) and mobile apps (35%) while farmers in Batticaloa relied heavily on radio (44%) and farmer organizations (39%) indicating significant regional differences in preferred information sources that should guide targeted dissemination strategies. Additionally, analysis revealed that 58 percent of paddy farmers initially became

aware of TV as a source of WI through family members, specifically via news alerts. Moreover, 88 percent of paddy farmers initially learned about printed media (leaflets, posters, and handouts) as a source of WI through fellow farmers. This reliance on printed media highlights the importance of interpersonal networks and traditional communication methods in effectively reaching paddy farmers.

4.5 Information related to WI Service Provider

The role of service providers of WI is crucial in empowering farmers, as they serve as a bridge between scientific research and practical applications, ensuring that WI is translated into actionable insights for farmers. Therefore, it is important to examine their role in disseminating WI among the paddy farmers included in the sample. As presented in Figure 4.4, among the total sample, 97 percent of farmers reported that WI was primarily provided by government organizations, including the Department of Meteorology (DoM), the Department of Agriculture (DoA) and the Department of Agrarian Development (DAD). Government organizations are the primary providers across all districts showing their central role in disseminating WI. Ampara and Batticaloa rely almost entirely on government sources, showing limited alternative providers. Kurunegala shows some involvement of private sector and NGOs but still government is dominant. Vavuniya is unique because farmers rely not only on government but also heavily on their own experience.

Additionally, the Food and Agriculture Organization (FAO) has initiated a climate-related project in the Nedunkerny ASC area of Vavuniya and Panama ASC area in Ampara. This project focuses on improving farmers' access to reliable WI and fostering resilience to climate-related challenges in the paddy sector. Such initiatives aim to enhance timely decision-making and promote sustainable agricultural practices among farmers in the region.



Source: HARTI Survey Data, 2024.

Figure 4.4: Service Provider of Weather Information

A majority of farmers (95%) perceive WI as either highly reliable or at least somewhat reliable, which indicates a generally strong level of trust. Only a small fraction (5%) considers it is not reliable meaning complete distrust is minimal. Building robust trust will require addressing gaps in fully meeting farmers' needs by improving communication strategies, ensuring the provision of timely and localized information and fostering stronger partnerships with farmers to validate and contextualize the climate data being disseminated.

Among sample farmers, various modes were used to disseminate WI such as weather forecasts, bulletins, posters, printed materials, face to face briefings, real time updates, notifications, weather alerts and interactive maps. Among them, weather forecasts were identified as the most delivered mode of WI through TV (81%), radio (69%) and printed media (reaching the entire sample who received WI via printed media). Face-to-face briefings were identified as the most delivered mode of WI through farmer organizations (100%) and extension services (99%). Meanwhile, real-time updates were the predominant mode through mobile apps, reaching 100 percent of farmers who received WI via these platforms.

CHAPTER FIVE

Accessibility and Utilization of Weather Information

5.1 Introduction

Chapter four discussed the availability of WI to farmers, WI services, channels and their service providers. This Chapter explores both the degree to which that information reaches the end users —paddy farmers in this study — and how it is utilized. Understanding how farmers perceive, access and apply this information is crucial for designing interventions that enhance resilience and ensure sustainable agricultural practices in the face of climate variability and change.

5.2 Access to Weather Information and Use in Crop Farming

This paragraph describes the extent of WI accessibility among paddy farmers, reflecting their reliance on such data for agricultural decision-making (Table 5.1). A majority (64%) have accessed to WI occasionally, indicating that most farmers prioritize obtaining information during critical periods, such as before sowing, during irrigation planning or in response to adverse weather conditions. This pattern suggests a reactive approach, where farmers seek information primarily in response to immediate agricultural needs. On the other hand, 31 percent of farmers have accessed to WI frequently. A small proportion (5%) accessed it rarely, highlighting a gap in consistent information flow. Thibbotuwawa (2018) found that 73 percent of farmers regularly accessed daily weather reports through public media. This figure is more than double the findings of the current study.

In terms of accessibility, 51 percent of farmers find WI very or highly accessible. This feedback reflects a positive trend in reducing the information gap for agricultural decision-making. However, it also implies that nearly half (49%) face challenges in obtaining timely or relevant climate-related information, indicating that further improvements are necessary to address the barriers faced by the remaining farmers. It was reported by nearly 40 percent of the total sample of farmers that WI was used sometimes to make farming decisions. All the KIIs in the five districts interviewed reported using WI, showing a 100 percent positive response as KIIs. The primary source identified was *pre-season meetings*, while additional inputs were obtained through WhatsApp groups, particularly in the Palugaswewa ASC area in Anuradhapura district. As per the KIIs interviewed, farmers mainly applied these WI for land preparation, broadcasting and determining harvest timing. It was observed that nearly 12 percent of farmers did not use WI when making farming decisions, even though it had been received.

Instead, decisions were based on their own experience and traditional knowledge, with greater trust being placed in these methods rather than in external sources of WI dissemination. This pattern was commonly observed among respondent farmer households across almost all ASCs in the selected five districts. However, this reliance

on experience was noted to potentially limit the farmers' ability to adapt to changing climatic conditions, thereby affecting agricultural outcomes.

This finding is supported by Thibbotuwawa (2018), who found that climate-related decisions by farmers were primarily based on personal observations and expectations. Despite the availability of scientific weather forecasts, indigenous knowledge continued to be relied upon more heavily by local farmers. Farmers also noted that recent global climate changes and local environmental alterations have reduced the reliability of traditional predictions, indicating that while such methods were previously accurate, they are no longer as dependable.

Table 5.1: Farmer Access, Utilization and Perceived Usefulness of Weather Information

Criteria	Percentage of Paddy Farmers
Frequency of Access to WI	
Frequently	31
Occasionally	64
Rarely	5
Accessibility of WI	
Very accessible	51
Somewhat accessible	34
Not accessible	5
Frequency of WI Usage	
Always	24
Sometimes	40
Rarely	24
Never	12
Usefulness of WI	
Somewhat helped	60
Not at all	13
Greatly helped	27

Source: HARTI Survey Data, 2024.

Additionally, it was observed that WI was somewhat helpful for 60 percent of farmers in the sample when making farming decisions, indicating that the insights provided were beneficial. For 27 percent of farmers, the information was reported to have greatly helped, demonstrating its potential to significantly improve agricultural planning when effectively utilized. The variations in the degree of usefulness were attributed to differences in the relevance, accessibility and understanding of the provided WI across the farming population with different ethnicities. About 13 percent found it minimally or not useful, suggesting that while most farmers recognize some value in WI, there is room to improve its relevance, accuracy and delivery. Overall, the data points to moderate levels of access and usage, with potential for enhancing the effectiveness and consistency of WI delivery to support informed decision-making in agriculture.

Table 5.2 presents the relationships between socio-economic variables and three key aspects of WI access and use among farmers:

1. Frequency of accessing WI
2. Access to WI
3. Frequency of using WI in decision-making
4. Extent to which WI helped in making farming decisions

Table 5.2: Association between Socio-economic Variables and Access to Weather Information among Paddy Farmers

Criteria	χ^2 (df, N)	Chi-Value	p-value
1. Frequency of accessing to WI			
1. Age	$\chi^2(6, N=445)$	19.631	$p < 0.05$
1.2 Secondary employment status	$\chi^2(8, N=445)$	30.628	$p < 0.05$
2. Access to WI			
2.1 Age	$(\chi^2(6, N=445))$	17.065	$p < 0.05$
2.2 Degree of engagement in agricultural activities	$\chi^2(2, N=445)$	9.395	$p < 0.05$
3. How often farmers used WI in decision-making			
3.1 Making specific farming decisions	$(\chi^2(27, N=445))$	1035.188	$p < 0.05$
3.2 Extent of WI helped to make farming decisions	$(\chi^2(6, N=445))$	609.401	$p < 0.05$
4. Extent of WI helped to make farming decisions			
4.1 Engagement in agriculture	$\chi^2(2, N=445)$	7.865	$p < 0.05$
4.2 Secondary employment	$(\chi^2(8, N=445))$	25.319	$p < 0.05$
4.3 Making specific farming decisions	$(\chi^2(18, N=445))$	921.858	$p < 0.05$
4.4 Availability of WI affected farming practices	$(\chi^2(10, N=445))$	362.169	$p < 0.05$

Source: HARTI Survey Data, 2024.

Findings of Table 5.2 are summarized below:

The Frequency with which WI was accessed through the previously identified channels or services was significantly associated with the age and secondary employment status of the principal farmer. Almost half of the farmers aged 50-64 years (51%) accessed WI frequently, whereas 39 percent of middle-aged farmers (35-49 years) reported accessing WI only occasionally. Among the principal farmers, those with agricultural secondary employment most frequently accessed WI, with 47 percent reporting frequent access compared to other employment categories.

Access to WI is significantly influenced by various socio-demographic characteristics of the principal farmer. Specifically, factors such as the farmer's age and degree of engagement in agricultural activities were all found to be associated with how easily they could access climate-related information. The 50-64 years age group had the highest proportion of farmers who rated WI sources as very accessible, with 38 percent reporting this perception compared to other age groups. A large majority of

full-time farmers (83%) rated WI sources as very accessible, compared to only 17 percent of part-time farmers.

There is a significant association between the frequency with which farmers used WI in their decision-making and the specific farming decisions they made based on that information. Among farmers who always used WI, the highest proportion (55%) applied it when deciding the timing of threshing, while 45 percent used it to determine the timing and quantity of fertilizer application. This highlights the strong influence of WI on critical post-harvest and input management decisions.

Moreover, there are very strong associations between extent to which WI was helpful in making farming decisions related to paddy cultivation and the use of WI. These associations include certain socio-demographic characteristics of the principal farmer such as engagement in agriculture and secondary employment, as well as how frequently farmers used WI in their decision-making processes, the specific farming decisions made based on the received information (such as timing of planting, irrigation or fertilizer application) and the overall impact that the availability of WI had on their farming practices.

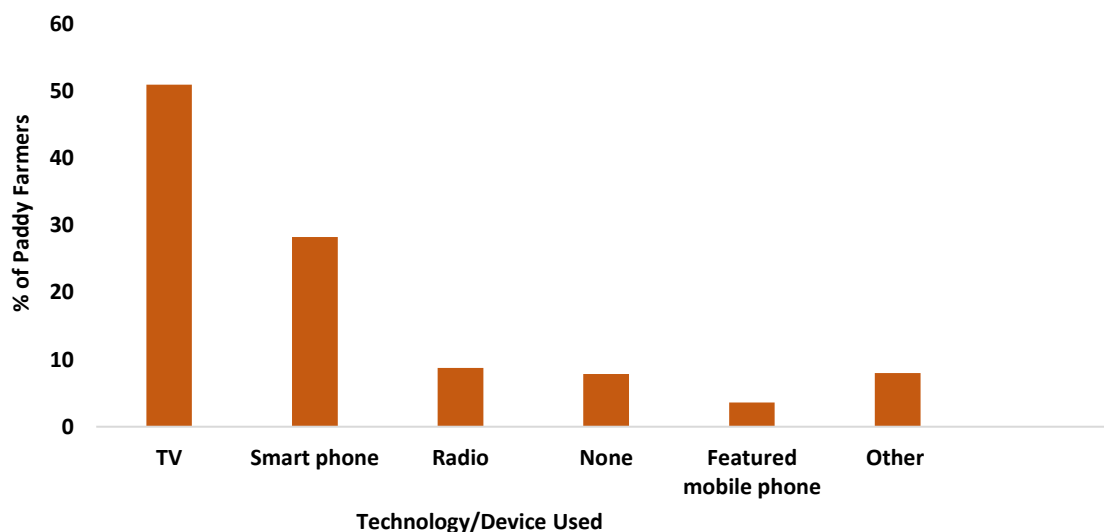
A significant majority (87%) of full-time farmers reported that WI greatly helped in making paddy farming decisions. Among these farmers, the highest proportion (41%) had no secondary employment, indicating a stronger reliance on WI among those fully dependent on farming income. Additionally, 54 percent used WI to decide when to start threshing, while 53 percent applied it for irrigation scheduling, highlighting the critical role of WI in key farming activities.

Further analysis revealed that among farmers who reported that WI greatly helped their paddy farming decisions, the vast majority (77%) consistently used WI in their decision-making. Additionally, among those who indicated that WI somewhat helped their decisions, the highest proportion (67%) experienced improved resource management as a result of using WI.

As presented in Figure 5.1, 51 percent of the sample used TV to access WI, reflecting its significance as a traditional medium for disseminating WI to paddy farmers. TV remains a widely accessible medium, especially in rural areas where digital penetration might still face infrastructural and economic constraints. This highlights the potential benefits of fostering collaboration between DoM and broadcasters to develop farmer-friendly weather segments tailored to regional agricultural practices. The findings also underscore that traditional media like TV continue to be highly accessible and important sources of WI for this community.

Approximately 28 percent of paddy farmers accessed WI through smartphones, a trend primarily observed among the younger generation involved in paddy farming. This indicates a growing adoption of smartphones in agriculture, enabling farmers to receive real-time weather forecasts, farming advisories and access digital tools. This technological shift is facilitated by the younger farmers' familiarity with mobile

applications and comfort with digital interfaces. KIIs highlighted those novel technologies, such as smartphones are poorly utilized by elderly farmers, whereas younger farmers demonstrate greater usage.



Source: HARTI Survey Data, 2024.

Figure 5.1 Technology/Device Used to Access to Weather Information

Devices such as feature phones, laptops and tablets were used by farmers to access WI, though to a lesser extent. The affordability and availability of radios in rural areas provide an important alternative for those without internet access. Basic weather updates were received via feature phones through short message service (SMS) or voice calls. Laptops and tablets, being less frequently utilized, were mainly used by farmers with greater resources. Notably, around eight percent of paddy farmers did not use any technological device to access WI. Consequently, their ability to make timely and informed decisions may be limited, potentially affecting their productivity and resilience to climate variability.

Farmers in Ampara used a mix of smartphones and alternative channels but TV is less influential compared to other districts. Most diversified use of technologies; smartphones and TV lead among farmers in Anuradhapura but traditional and alternative channels are also important. Farmers in Batticaloa are heavily dependent on feature phones and radio with limited reliance on TV and smartphones in accessing to WI. As per the KIIs interviewed in five districts, the status of technology use among paddy farmers to access WI shows generally low adoption, with most relying on TV as the primary source. In many areas, only 5–10 percent of farmers own smart phones and even fewer actively use them for climate updates. Some farmers access WI through WhatsApp groups (such as *Waw Gam Pubuduwa* and ASC-organized groups) but participation and sharing remain limited, especially among older farmers. A few use apps like *ESONA*, while others receive updates indirectly through their children who use smart phones. In certain locations, adoption is higher (around 60–70% participation in WhatsApp groups) but overall, most farmers are not familiar with

different digital platforms or websites, depending instead on *pre-season meetings*, radio, TV broadcasts and phone messages. Social media (YouTube, Facebook) is emerging but still limited.

Further, inferential analysis identified statistically significant associations between the technology or the device used to receive WI and specific socio-demographic characteristics of the principal farmer. Notably, the farmer's age [χ^2 (12 N=445) = 59.417, $p < 0.05$] and gender [χ^2 (4, N=445) = 20.224 $p < 0.05$] influenced which technologies or devices were used to access climate-related information. The 50–64 years age group had the highest proportion of farmers using TV to access WI (45%), while the 35–49 years group was the largest user of smartphones (42%). Male farmers predominantly used TV (78%) and smartphones (82%) to access WI, whereas female farmers showed a slightly higher proportion (51%) of using other devices such as laptops, tablets and desktop computers compared to males.

Fifty six percent of the farmers stated that the WI received was very clear, reflecting the effectiveness of current communication strategies in ensuring clarity and understandability. However, nearly seven percent of the farmers indicated that the information was unclear. Challenges such as the use of complex terminology, insufficient localization or inadequate explanation with more information have been suggested as contributing factors. Improvements in these areas are necessary to ensure that all farmers, regardless of their educational background or technological proficiency, can fully utilize the information provided.

In particular, the way WI was presented — whether as audio clips, texts, video clips, printed materials or digital content — had a notable impact on how clearly and easily farmers were able to comprehend the information. Nearly 82 percent of the farmers in the sample reported receiving WI in the form of audio-visual formats (audio clips and video clips), making it the most common format used. In Anuradhapura, 31 percent of farmers were provided WI in visual format, 31 percent in audio-visual formats and 40 percent were provided as verbal or oral formats. In addition to that, 30 percent of farmers in Batticaloa were provided WI as visual formats. In Kurunegala, 33 percent were provided as audio-visual formats.

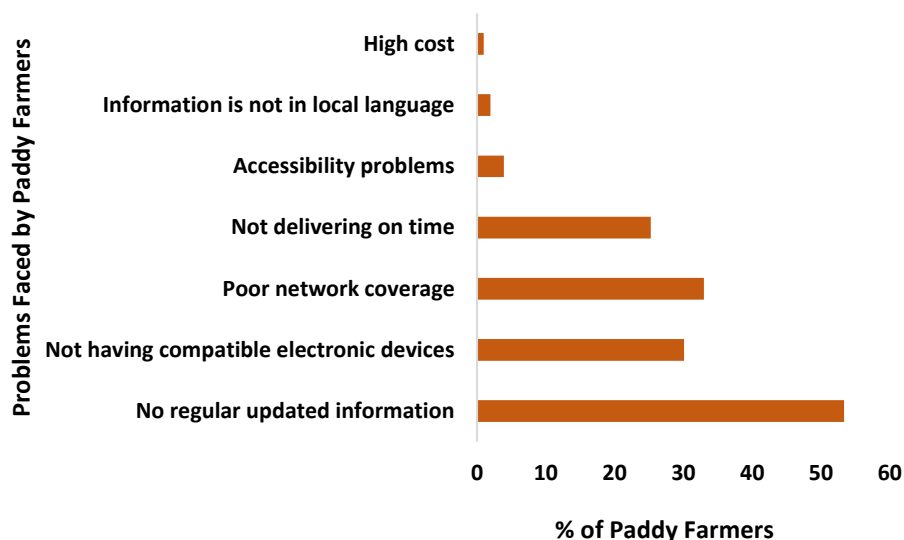
This was followed by visualized formats (texts, graphs, charts and maps), which were received by 36 percent of the farmers, while seven percent obtained WI as verbally or orally. These findings suggest that visual and audio-based formats are preferred by farmers for understanding climate-related updates and advice. Further, the results emphasize the importance of using appropriate and user-friendly formats to enhance the effectiveness of WI dissemination among farming communities.

The clarity and understandability of WI dissemination are significantly influenced by language barriers. It has been observed that farmers who are not proficient in the language used for communication face challenges in accurately interpreting the information, resulting in potential confusion or misapplication. In regions with diverse linguistic populations such as Vavuniya, Batticaloa and Ampara, the use of a single

language for dissemination is inadequate. Instead, WI should be provided in Sinhala, Tamil and English languages to accommodate all communities. To enhance accessibility and usability, it is recommended that WI be delivered in languages that are clearly understandable to the target farming populations.

5.3 Problems Faced in Access to Weather Information

Paddy farmers in the study sample face several challenges in accessing WI, which can hinder their ability to adapt to changing weather patterns and improve their agricultural practices.



Note: The sum of the percentages of farmers exceeds 100 due to multiple problems faced by farmers when accessing to WI.

Source: HARTI Survey Data, 2024.

Figure 5.2: Problems Faced by Paddy Farmers when Accessing to Weather Information

Among the sample farmers, around 53 percent reported the problem of not receiving regularly updated information (Figure 5.2). The lack of regular updates may stem from inadequate communication systems, delays in data processing or inefficiencies in the distribution network. Addressing this issue is crucial to ensure farmers have access to the most current and relevant WI, enabling them to adapt effectively to changing conditions.

The second most significant problem, poor network coverage, was reported by around 33 percent of paddy farmers. This issue was specifically experienced in rural areas across all five districts studied. The lack of reliable network coverage limits access to timely WI, hindering farmers' ability to make informed decisions. This problem likely stems from insufficient telecommunications infrastructure in these areas, underscoring the need for targeted investments to improve connectivity and bridge the digital divide for rural farming communities.

Around 30 percent of paddy farmers faced the problem of not having compatible electronic devices to access WI represents a significant barrier to utilizing digital tools and platforms for obtaining essential climate data. The issue is particularly common among elderly farmers who may lack the financial resources to invest in modern devices such as smartphones or tablets.

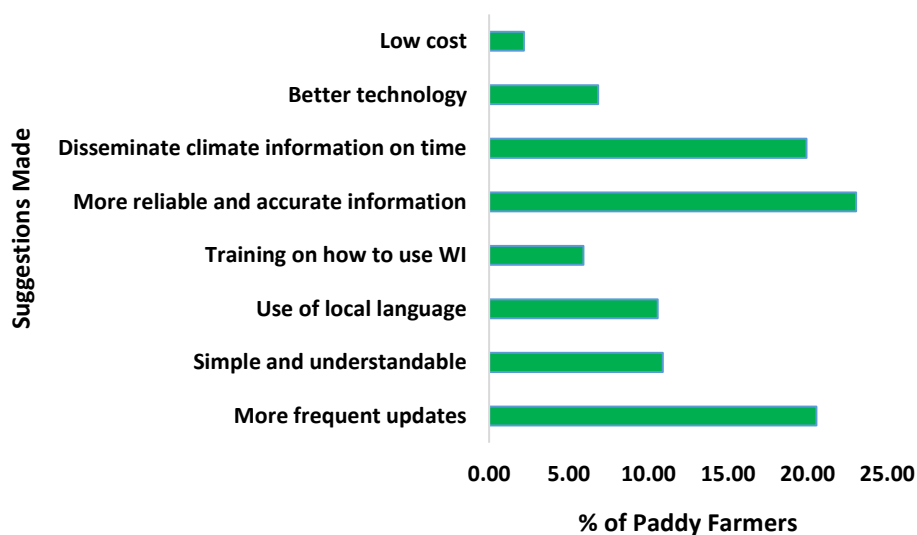
Additionally, about one-fourth of the sample farmers reported delays in receiving WI (not delivering on time). Such untimely delivery can critically affect farming decisions, as timely information is crucial for activities such as planting, irrigation and harvesting. Addressing these challenges is vital to ensure farmers receive necessary updates promptly, enabling them to adapt their practices effectively to changing climatic conditions.

Additionally, the analysis shows that while many farmers reported no problems in accessing WI, notable issues included poor network coverage — especially in Kurunegala (56%)— lack of compatible electronic devices, highest in Anuradhapura (48%) and no regular updates, reported by 44% of farmers in both Anuradhapura and Kurunegala. These findings indicate that technological and infrastructural barriers remain significant constraints to effective WI access in these districts.

The main issues farmers face in accessing WI can be grouped into a few key areas as stated by KIs interviewed in five districts. Technical barriers are common, such as not having compatible devices, poor mobile/internet signal and difficulties logging into websites or apps. Language and communication challenges also arise, since information is often not available in local languages or presented in a simple, farmer-friendly format—especially when using maps or images. Knowledge and skill gaps are significant, with many older farmers lacking awareness or training on how to use smartphones, websites or other digital tools. Trust and accessibility issues were also noted, including skepticism towards official information, limited extension services, economic constraints in purchasing devices and generational gaps where older farmers are excluded from platforms like WhatsApp groups.

5.4 Suggestions to Improve the Access to Weather Information

The previous paragraph outlined the problems encountered by paddy farmers in accessing WI. In the following section, the suggestions provided by farmers to address these challenges will be discussed in detail. As presented in Figure 5.3, nearly one-fourth (23%) of the paddy farmers in the sample suggested that more reliable and accurate WI should be disseminated to enhance successful access. Ensuring the accuracy of information is crucial for building farmers' confidence and enabling them to make better-informed decisions in their agricultural practices.



Note: The sum of the percentages of farmers exceeds 100 due to multiple suggestions made by farmers.

Source: HARTI Survey Data, 2024.

Figure 5.3: Suggestions to Improve Access to Weather Information

Secondly, 20 percent of the paddy farmers suggested that WI should be updated more frequently. This highlights the importance of providing timely and regular updates to enable farmers to respond effectively to changing weather conditions. More frequent updates would enhance the relevance and usefulness of WI for agricultural decision-making. Additionally, around 19 percent of farmers emphasized the need for timely dissemination of WI to allow them to plan their agricultural operations ahead of climatic shocks. This underscores the critical role of punctual information in helping farmers prepare for and mitigate the impacts of adverse weather conditions. Ensuring timely access to climate data is essential for enhancing resilience and minimizing potential losses in farming activities.

In addition to the aforementioned suggestions, farmers recommended that WI be provided in local languages, presented in a simple and understandable manner, supported by better technology and accompanied by training on how to effectively utilize the information. These recommendations highlight the need for accessible and user-friendly approaches to ensure that farmers can fully benefit from climate data. Furthermore, the results indicate that farmers predominantly emphasized the need for more reliable and accurate WI (highest in Kurunegala, 57%), timely dissemination (Kurunegala, 53%) and use of local language (notably in Anuradhapura, 44%) while Kurunegala farmers also strongly emphasized the importance of better technology (59%) and affordable, low-cost options (100%). These findings suggest improvements in accuracy, timeliness, local language adaptation, technology, and affordability are key to enhancing the accessibility and usability of WI.

Of the KIs' Opinions to improve paddy farmers' access to WI, it is essential to ensure that information is timely, location-specific and delivered in local language (Sinhala and Tamil) through multiple channels such as voice messages, text messages, mobile

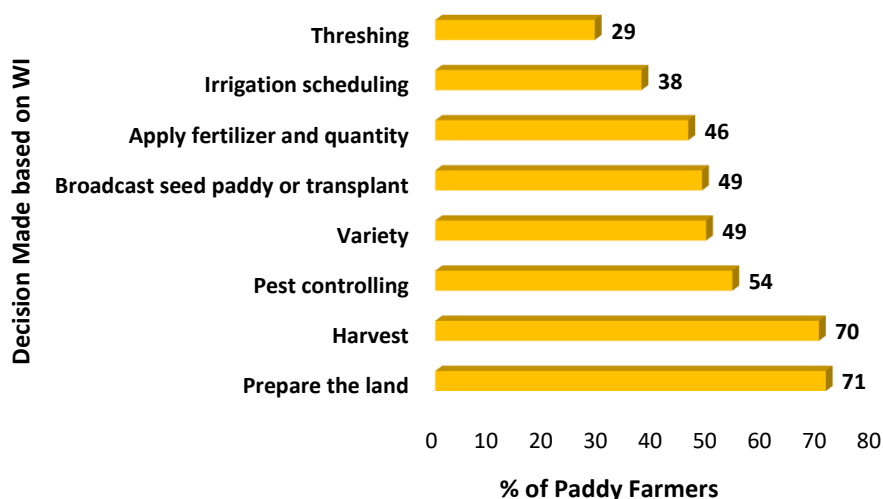
apps, printed handouts and WhatsApp groups. Strengthening infrastructure by improving mobile signal coverage, providing measurement instruments and equipping ASCs with technological devices will facilitate better information flow. Training and awareness programmes should be conducted to teach farmers how to use technology, access real-time data and apply WI in their farming decisions, with special attention to older farmers and division-level engagement. Establishing a direct link between the DoM and ASCs along with collaboration with the private sector will ensure continuous, reliable WI dissemination. Additionally, financial support such as loan schemes for smart devices and government-led climate information projects will further enhance farmers' ability to make informed climate-resilient decisions.

5.5 Usefulness of Weather Information in Decision Making by Paddy Farmers

As depicted in Figure 5.4, decisions regarding the timing of land preparation and harvesting have been made by nearly 71 percent and 70 percent of paddy farmers respectively, based on the WI provided to them. This highlights the significant role of climate data in shaping agricultural practices among the majority of the farming community.

The use of such information demonstrates an effort to align farming operations with climatic conditions to mitigate risks and improve efficiency. The timing of these two operations is significantly influenced by climate change, making them highly sensitive within paddy cultivation under any irrigation system. This emphasizes their vulnerability to climatic variations and highlights the critical need for careful planning and adaptive strategies to reduce potential impacts. Approximately 54 percent of paddy farmers have made decisions on when to implement pest control measures based on the WI received. This indicates a growing awareness of the influence of climatic conditions on pest outbreaks, leading to more informed and potentially effective pest management practices.

Additionally, around 49 percent of farmers reported making decisions regarding the timing of broadcasting or transplanting and the selection of crop varieties based on the WI provided. This reflects an effort to align key agricultural practices with prevailing climatic conditions to improve outcomes. However, the relatively low adoption rate also suggests that a significant portion of farmers are not fully utilizing WI, underscoring the need to enhance both the accessibility of such information and farmer education on its practical application.



Note: The sum of the percentages of farmers exceeds 100 due to multiple decisions were made based on WI they received.

Source: HARTI Survey Data, 2024.

Figure 5.4 Decisions Made based on Weather Information

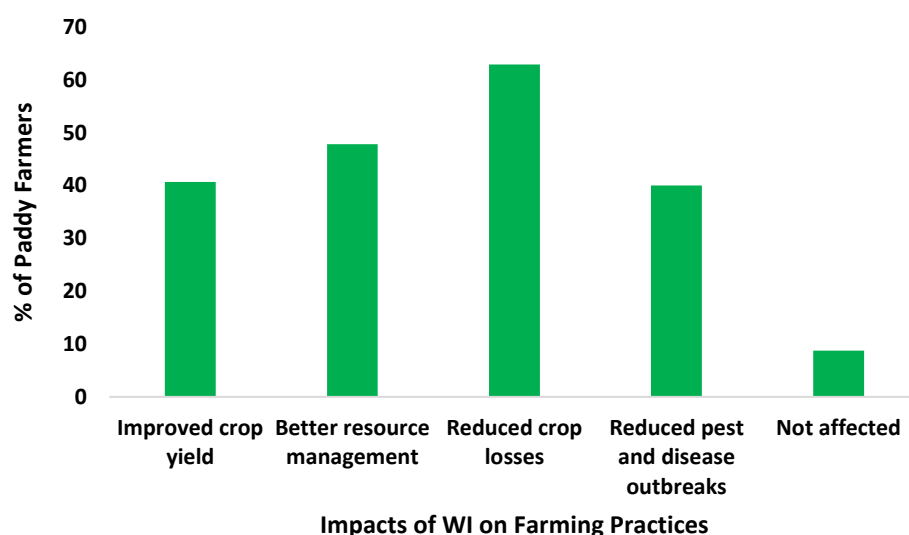
Furthermore, the findings indicate that farmers primarily used WI for decisions such as land preparation (notably in Anuradhapura, 34%, and Kurunegala, 28%), choosing paddy varieties (highest in Kurunegala, 34%), pest control (Batticaloa, 26%) and irrigation scheduling (Kurunegala, 35%) while only a small proportion, mainly in Kurunegala (63%) reported not using WI for any decisions, highlighting its significant role in agricultural planning across districts.

Approximately 63 percent of paddy farmers were able to reduce crop losses caused by climatic hazards such as droughts and floods by using WI to make informed farming decisions (Figure 5.5). This highlights the effectiveness of integrating climate data into agricultural decision-making to mitigate the adverse effects of extreme weather events. The substantial adoption rate highlights the potential of climate-informed practices to enhance resilience and sustainability in paddy cultivation.

Better resource management, including land, labor and inputs, was achieved by around 48 percent of paddy farmers in the sample through the use of WI in their farming operations by minimizing waste of inputs, reducing risk from adverse weather conditions, efficient use of labour, enhancing productivity and cost-effectiveness. For instance, knowing expected rainfall patterns helped them schedule land preparation and planting at the optimal times, reducing wastage of water and labour. Moreover, weather forecasts guided the timely application of fertilizers and pesticides, minimizing input losses and lowering costs. This highlights the potential of climate-informed practices to enhance efficiency and optimize resource utilization.

However, the fact that more than half of the farmers have not yet adopted such practices highlights the need for improved dissemination of climate data and targeted training programmes to expand its application in resource management. Improved

resource management may also result in reduced production costs such as lower water consumption during irrigation or more efficient labour deployment during critical periods. Approximately nine percent of paddy farmers in the sample did not experience any notable impacts from using WI for their farming operations. This suggests that, for a subset of farmers, the integration of climate data did not translate into tangible benefits.



Note: The sum of the percentages of farmers exceeds 100 due to multiple impacts were observed in their farming practices.

Source: HARTI Survey Data, 2024.

Figure 5.5: Impacts of Weather Information on Farming Practices

In Anuradhapura, WI has had the strongest impact, mainly on reducing crop losses (39% of farmers stated), while also improving crop yields (37% of farmers), enhancing resource management (31% of farmers) and lowering pest and disease outbreaks (30% of farmers). Further, in Kurunegala, WI shows high impacts across all areas, with notable effects on improved crop yields (35% of farmers), better resource management (35% of farmers), reduced pest and disease outbreaks (34% of farmers), and minimized crop losses (28% of farmers).

5.6 Dissemination of Weather Information via Government Institutional Set-up: A Case of *Pre-Season Meetings*

The *Pre-season meetings* held at every Agrarian Service Center (ASC) serve as an important institutional mechanism for disseminating WI, including guidance on farming operations. Thibbotuwawa (2018) highlighted these *pre-season meetings* as a traditional source of WI dissemination within the Sri Lankan farming community. This section explains how these meetings facilitate the distribution of such information among farming communities, by bridging the gap between available data and its practical application. The 2024 *yala* is considered as the reference period from this point onwards.

During the dissemination of WI through *pre-season meetings*, the DoM first provided the information to the district DAD offices. The district DAD office then communicated it to the ASCs, which subsequently organized the *pre-season meetings* where the information was shared with farmers. Eighty percent of farmers stated that the *pre-season meetings* were conducted at their respective ASCs for the *yala 2024* season. The remaining farmers reported that such meetings were not held due to ongoing tank rehabilitation activities. Three-fourths of the sample paddy farmers were reported to have participated in these *pre-season meetings*. The remaining farmers did not attend, as they were not planning to cultivate during the *yala 2024* season.

It was reported by 97 percent of paddy farmers that their ARPAs attended the *pre-season meetings*. Additionally, 63 percent stated that Als participated in these meetings as government representatives. This observation implies the active involvement of key agricultural officials in disseminating information during *pre-season meetings*. It was stated by around 40 percent of farmers that the respective Divisional Officer (DO) participated in the *pre-season meetings* as the head of the ASC, representing the Department of Agrarian Development (DAD). This highlights the involvement of higher-level officials in overseeing and supporting the dissemination of agricultural information. Apart from these government officials, the *pre-season meetings* conducted for *yala 2024* were attended by Grama Niladharis, Divisional Secretariat representatives and Irrigation officials as other government officials.

The majority of paddy farmers mentioned that during the *pre-season meetings* conducted for *yala 2024*, decisions were primarily made regarding the duration of land preparation, the selection of varieties to be grown and the date of harvesting. Additionally, decisions were made on the duration of broadcasting or transplanting, the schedule for releasing irrigated water, methods of water distribution and its time table, the date of threshing, crop protection programmes and other traditional customs in paddy cultivation. This highlights the comprehensive planning undertaken during these meetings to support effective farming operations.

When considering land preparation, half of the sample (49%) stated that land preparation for *yala 2024* was scheduled to be conducted in March, as decided during their *pre-season meetings*. This decision was followed by 94 percent of the paddy farmers for *yala 2024*. Furthermore, nearly 94 percent of the farmers reported receiving this information through the *pre-season meetings* held. This demonstrates the effectiveness of these meetings in disseminating agricultural decisions and ensuring high compliance among farmers. When it comes to broadcasting or transplanting, 42 percent of farmers mentioned that these activities for *yala 2024* were planned to be conducted in March, as decided during their *pre-season meetings*. This decision was adhered to by 96 percent of paddy farmers, with nearly 96 percent indicating that they received this information through the *pre-season meetings*. This highlights the significant role of these meetings in conveying key agricultural decisions and ensuring widespread adherence among farmers.

For *yala* 2024, 38 percent of farmers stated that harvesting/threshing was scheduled in July, as decided during their *pre-season meetings*. This decision was adhered to by 90 percent of the paddy farmers, with the same percentage confirming that they received this information through the *pre-season meetings*. This finding highlights the pivotal role of these meetings in ensuring the timely dissemination of harvesting schedules.

5.7 Factors Determining Access to and Utilization of Weather Information

In this analysis, access to WI and the extent to which WI helped to make farming decisions in paddy cultivation were the dependent variables, while the other socio-economic, demographic and other relevant factors served as independent variables. The following paragraphs explain the results of the multinomial logistic regression analysis, which examined the factors affecting to access of WI. The significant Chi-Square test result ($p < 0.001$) indicates that the final model provides a statistically significant improvement in fit over the Intercept only model. In other words, the predictors included in the multinomial logistic regression significantly enhance the model's ability to explain variations in the accessibility of WI.

This suggests that the independent variables collectively contribute meaningful information for predicting the outcome variable, improving model performance compared to a model with no predictors. Therefore, we can conclude that the final model is a better fit for the data and is suitable for interpreting the effects of the predictors on accessibility of WI. Additionally, Goodness-of-Fit statistics were used to assess how well the multinomial logistic regression model fits the observed data. Two tests are reported: the Pearson Chi-Square and the Deviance statistic. The Pearson Chi-Square value is 985.997 with 700 degrees of freedom and a significance level of 0.000. This statistically significant result suggests a difference between the observed and predicted values, indicating some lack of fit. However, this result should be interpreted with caution, as the Pearson test can be overly sensitive in models with large or sparse datasets, often producing significant results even when the model is generally appropriate.

In contrast, the Deviance statistic—commonly considered more reliable for evaluating model fit in multinomial logistic regression — has a value of 276.561 with the same degrees of freedom (700) and a significance level of 1.000. This non-significant result indicates no meaningful difference between the observed and expected values, suggesting that the model fits the data well. Overall, despite the Pearson test indicating some lack of fit, the non-significant Deviance test supports the conclusion that the model has a good overall fit and appropriately captures the structure of the data. Furthermore, the pseudo R^2 statistics provide an indication of how well the model accounts for variability in the accessibility of WI. In this output, all three commonly used pseudo R^2 measures—Cox and Snell (0.726), Nagelkerke (0.847) and McFadden (0.666)—show relatively high values. Among them, the Nagelkerke R^2 is especially notable, with a value of 0.847, which is considered very high in the context of logistic regression models. This suggests that the model explains approximately

84.7 percent of the variance in the accessibility of WI. While pseudo R^2 values are not directly comparable to R^2 in linear regression, these results collectively indicate that the model has a strong explanatory power and provides a good fit to the data. The likelihood ratio tests for individual predictors in the multinomial logistic regression model assess the significance of each independent variable by comparing the full model with a reduced model that omits the respective predictor (Table 5.3).

The results indicate that variables such as access to the internet (χ^2 (2, N=425) = 130.352, $p < 0.05$) and clarity of WI (χ^2 (4, N=425) = 92.141 $p < 0.05$) are highly significant, suggesting they strongly influence the model's predictive power. Similarly, received WI, technology/device used, frequency of access, share of income from agriculture and farmer-to-farmer extension service also show statistical significance, though with varying degrees of impact.

Table 5.3: Multinomial Logit Estimates for Accessibility of Weather Information

Independent Variables	Chi-Square value	<i>p</i> -value
District	27.996	0.000*
Access to internet	130.352	0.000*
Clarity of WI	92.141	0.000*
Receipt of WI	28.802	0.000*
Technology/Device used	22.791	0.030*
Frequency of access	13.740	0.033*
Share of income from agriculture	8.480	0.014*
Farmer-to-farmer extension service	10.661	0.005*
pseudo R^2	0.847	

* significance at $\alpha = 0.05$

Source: HARTI Survey Data, 2024.

The forthcoming paragraphs describe the results of the multinomial logistic regression analysis, which examined the factors affecting the extent to which WI helped farmers make decisions in paddy cultivation. The analysis explored various factors to understand how WI influences decision-making, identifying which variables have the greatest impact and which are less influential. The model fitting information helps assess how well the inclusion of predictors improves the model compared to the baseline intercept-only model.

In this case, the substantial reduction in the -2 Log Likelihood value from 783.000 to 115.312 indicates a significantly better fit with the predictors included. The Chi-Square statistic of 667.688 with 148 degrees of freedom confirms this improvement, demonstrating that the predictors collectively contribute to explaining variability in how WI helped with farming decisions. Furthermore, the significance level (*p*-value) of 0.000 suggests that this improvement in model fit is statistically significant, reinforcing the value of including predictors for more accurate classification. These results highlight that the final model is considerably more informative and effective in predicting outcomes compared to a model that excludes the predictor variables.

Furthermore, the Pearson Chi-Square value of 379.936 and the Deviance Chi-Square value of 115.312, both with 700 degrees of freedom, yield significance levels of 1.000. These high p-values indicate that there is no statistically significant difference between the model and the observed data, suggesting that the model fits the data well. In other words, the predictors included in the model adequately capture the underlying patterns in the data, and the model's predictions align with the actual observations. This strong fit reinforces the reliability of the model in making predictions, indicates that it is a robust tool for understanding the relationships between the predictors and the dependent variable in the context of the study. Overall, the goodness-of-fit results confirm that the model is appropriate for the data at hand.

In addition to that, pseudo R^2 values in multinomial logistic regression provide insight into how well the predictors improve the model's explanatory power compared to a null model. These values, such as Cox and Snell (0.792), Nagelkerke (0.941) and McFadden's R^2 (0.853) range between 0 and 1, with higher values indicating a better fit. For example, McFadden's R^2 values between 0.2 to 0.4 are typically considered indicative of a good model fit. In this context, the substantially high pseudo R^2 values observed suggest that the model effectively differentiates between categorical outcomes, reinforcing its validity and usefulness for prediction and classification.

Table 5.4 presents the results of likelihood ratio tests for individual predictors in a multinomial logistic regression model, focusing on their contributions to the overall model. The findings reveal that clarity of WI and the frequency with which WI is used in farming decisions are both highly significant predictors ($p < 0.001$), indicating a strong relationship with extent of WI helped in making paddy farming decisions.

Additionally, the presence of a *Pre-season* meetings and the accessibility of information sources also show statistical significance ($p < 0.05$), suggesting they meaningfully influence outcomes. Despite advancements in meteorological services and information dissemination technologies, the accessibility and effective utilization of WI among paddy farmers remain inconsistent.

Table 5.4: Multinomial Logit Estimates on the Extent to which Weather Information Helped in Farming Decisions

Independent Variable	Chi-Square value	p-value
Clarity of WI	31.859	0.000*
Frequency of WI used in farming decisions	312.534	0.000*
Participation in <i>pre-season</i> meeting for 2024 <i>yala</i> season	10.538	0.005*
Accessibility of information sources	11.067	0.026*
pseudo R^2	0.941	

* significance at $\alpha = 0.05$

Source: HARTI Survey Data, 2024.

CHAPTER SIX

Key Findings, Conclusions and Recommendations

6.1 Introduction

In Sri Lanka, agriculture faces severe challenges due to climate shocks and shifting weather patterns, with impacts that are often more severe than those observed in many other countries. Farmers are compelled to make daily management decisions amidst considerable climate uncertainty. Against this backdrop, the present research aimed to explore whether and how smallholder paddy farmers in rainfed and minor irrigated areas in Sri Lanka utilize WI in their crop management decisions. The study also sought to assess the benefits of such utilization, as well as to identify the opportunities and challenges associated with WI as a tool for building resilience in agricultural systems. This is a critical aspect that has not been adequately examined in previous studies, especially concerning rainfed and minor irrigated areas in Sri Lanka. The key findings and conclusions presented herein are based on the study conducted with a sample of 445 paddy farmers under rainfed and minor irrigated systems residing in Kurunegala, Anuradhapura, Ampara, Batticaloa and Vavuniya districts all located within the dry zone of Sri Lanka.

6.2 Key Findings and Conclusions

- Within this sample, it was observed that the majority of paddy farmers (99%) were aware of the mechanisms currently in place for disseminating WI across the country. The dissemination of WI is primarily facilitated through *pre-season meetings* conducted under the Department of Agrarian Services (DAD), the *Wewgam Pubuduwa* initiative led by the Department of Irrigation and the Climate Smart Irrigated Agriculture Project (CSIAP) implemented by the Ministry of Agriculture. These programmes were recognized for their prominence and accessibility within farming communities.
- When WI dissemination services and channels were examined, it was found that the majority of farmers (78%) relied on TV as their primary source for climate-related updates. Additionally, approximately 60 percent of farmers accessed extension services, which often involved direct interactions with Agricultural Instructors (AIs) and Agricultural Research and Production Assistants (ARPAs). The use of mobile applications (17%), text messages and voice messages (22%) further indicated that digital communication channels were effectively reaching the farming community. These findings highlight the growing integration of both traditional and modern communication methods in disseminating WI to farmers.
- In Batticaloa, radio and farmer organizations play a key role, highlighting the value of community-based and traditional communication channels. In Kurunegala and Ampara, farmers rely more on TV and extension services, though their use of digital platforms is relatively limited compared to other districts. Overall, TV,

extension services, and farmer organizations continue to be significant sources of information across all districts, while the level of digital adoption differs considerably.

- Among the surveyed farmers, the largest share of those accessing WI through TV were aged 50–64 years (41%). In contrast, the 35–49 age group recorded the highest use of mobile applications for WI, with 44% relying on them. Overall, most WI users were male farmers (76%), while female farmers (26%) represented a smaller share of the sample.
- It was reported by 97 percent of farmers that WI was primarily disseminated by government organizations. Key providers included the Department of Meteorology (DoM), the Department of Agriculture (DoA) and the Department of Agrarian Development (DAD). These government entities were identified as the principal sources of WI, playing a crucial role in equipping farmers with essential WI to support their agricultural practices and decision-making processes.
- In Ampara and Batticaloa, farmers depend almost exclusively on government sources, with few alternative providers available. In Kurunegala, while there is some participation from the private sector and NGOs, government sources still play the leading role. Vavuniya stands out, as farmers there draw not only on government support but also place significant reliance on their own farming experience.
- Among the various modes of delivery, weather forecasts were recognized as the most commonly disseminated form of WI via TV. These weather forecasts were delivered through TV, which reached 81 percent of farmers and radio, which reached 69 percent of farmers. Additionally, printed media proved to be a highly effective medium, successfully reaching the entire sample of farmers who received WI through this channel. These findings highlight the widespread reliance on both electronic and traditional media for the delivery of weather-related updates to the farming community.
- It was observed that the majority of farmers (64%) accessed WI occasionally, while 31 percent accessed it frequently. This indicates that most farmers utilized WI based on specific requirements or immediate needs, whereas a smaller but significant proportion integrated WI into their daily routines. These patterns highlight variations in the frequency of WI usage, reflecting differences in individual farming practices and decision-making approaches.
- Almost half of the farmers aged 50-64 years (51%) accessed WI frequently, whereas 39 percent of middle-aged farmers (35-49 years) reported accessing WI only occasionally.
- More than half of the sample farmers (51%) emphasized that WI sources were highly accessible. This finding emphasizes the effectiveness of current dissemination mechanisms in ensuring that a significant proportion of the farming

community can easily obtain the WI needed to support their agricultural practices and adapt to climate-related challenges.

- The 50-64 years age group had the highest proportion of farmers who rated WI sources as very accessible, with 38 percent reporting this perception compared to other age groups. A large majority of full-time farmers (83%) rated WI sources as very accessible, compared to only 17 percent of part-time farmers.
- Approximately 40 percent of the total sample of farmers reported utilizing WI sometimes to make their farming decisions. However, it was observed that nearly 12 percent of farmers, despite having received WI, chose not to incorporate it into their decision-making processes. Instead, farming decisions were predominantly influenced by farmers' own experience and traditional knowledge, which were trusted more than external sources of WI. This reliance on familiar and time-tested methods highlights a preference for localized, experiential strategies over externally disseminated WI, underscoring the importance of integrating traditional practices with modern climate advisory services to enhance their credibility and adoption. It was observed that WI was somewhat helpful for 60 percent of farmers in the sample when making farming decisions. For 27 percent of farmers, it was reported to have greatly helped. About 13 percent found it minimally or not useful.
- It was found that 51 percent of the sample relied on TV to access WI, highlighting its continued importance as a traditional medium for paddy farmers. Approximately 28 percent of paddy farmers accessed WI through smartphones, with this trend being notably prevalent among the younger generation engaged in paddy farming, reflecting their familiarity with modern technology. Conversely, it was observed that around eight percent of paddy farmers did not utilize any technological devices to access WI, indicating potential gaps in technology adoption within certain segments of the farming community.
- In Ampara, farmers relied on both smartphones and alternative channels, though television played a smaller role compared to other districts. In Anuradhapura, farmers showed the widest use of different technologies, with smartphones and television being the main sources, alongside continued reliance on traditional and alternative channels. In Batticaloa, farmers depended largely on feature phones and radio, with only limited use of television and smartphones for accessing WI.
- Farmers aged 50–64 made up the largest share of those using TV to access WI (45%) while the 35–49 age group had the highest proportion of smartphone users (42%). Male farmers were the main users of both TV (78%) and smartphones (82%) for accessing WI, whereas female farmers showed a slightly greater tendency (51%) to use alternative devices such as laptops, tablets and desktop computers compared to their male counterparts.
- Approximately 56 percent of the farmers stated that the WI they received was very clear. However, it was noted that the clarity and comprehensibility of WI dissemination were significantly affected by language barriers. In regions with

linguistically diverse populations, such as Vavuniya, Batticaloa and Ampara districts, it was emphasized that using a single language for WI dissemination should be avoided. Instead, WI should be provided in Sinhala, Tamil and English to ensure that all farmers, regardless of their linguistic background, can access and fully understand the information. This approach highlights the importance of multilingual communication to promote inclusivity and enhance the effectiveness of WI dissemination across diverse farming communities.

- Almost 82 percent of farmers in the sample reported receiving WI through audio-visual formats such as audio and video clips, making this the most widely used format. Next in importance were visual formats such as texts, graphs, charts and maps, which were accessed by 36 percent of farmers while only seven percent received WI verbally or orally. In Anuradhapura, WI was shared with farmers in different ways: 31 percent received it in visual form, another 31 percent through audio-visual formats, and 40 percent in verbal or oral form. In Batticaloa, 30 percent of farmers received WI in visual formats while in Kurunegala, 33 percent accessed it through audio-visual formats.
- Among the sample of farmers, around 53 percent reported that they did not receive regularly updated WI. The second most significant issue, poor network coverage, was reported by approximately 33 percent of paddy farmers. Additionally, about 30 percent of farmers faced the problem of not having compatible electronic devices to access WI. These challenges highlight the barriers that hinder effective access to WI, indicating a need for improved infrastructure, regular updates and the provision of appropriate technology to enhance WI accessibility for all farmers.
- The analysis also revealed that, although many farmers did not face difficulties in accessing WI, several challenges were notable. Poor network coverage was reported by 56 percent of farmers in Kurunegala, a lack of compatible electronic devices affected 48 percent in Anuradhapura and 44 percent of farmers in both Anuradhapura and Kurunegala cited irregular updates as an issue. These results highlight that technological and infrastructural limitations continue to pose significant barriers to effective access to WI in these districts.
- Nearly one-fourth (23%) of the paddy farmers in the sample suggested that more reliable and accurate WI should be disseminated to improve its successful access. Additionally, 20 percent of the farmers suggested that WI should be updated more frequently to ensure its relevance and usefulness. Furthermore, around 19 percent of paddy farmers emphasized the importance of timely dissemination of WI. These suggestions reflect the farmers' desire for more consistent, accurate and timely WI to better support their decision-making and enhance the resilience of their farming practices.

- Moreover, the findings show that farmers placed the greatest importance on having more reliable and accurate WI, with 57 percent of Kurunegala farmers highlighting this need. Timely dissemination was also a priority for 53 percent of farmers in Kurunegala while the use of local language was particularly important in Anuradhapura (44%). Additionally, Kurunegala farmers strongly emphasized the need for improved technology (59%) and affordable, low-cost options (100%).
- Decisions regarding the timing of land preparation and harvesting were made by nearly 71 percent and 70 percent of paddy farmers, respectively, based on the WI provided to them. Additionally, approximately 54 percent of farmers reported using WI to determine the appropriate timing for implementing pest control measures. These findings highlight the significant role of WI in guiding critical agricultural activities, enabling farmers to align their practices with weather patterns and climate forecasts, thereby improving efficiency and productivity in paddy farming.
- Furthermore, the results reveal that farmers mainly relied on WI to guide decisions on land preparation—particularly in Anuradhapura (34%) and Kurunegala (28%)—selecting paddy varieties, with the highest use in Kurunegala (34%), pest control in Batticaloa (26%) and irrigation scheduling in Kurunegala (35%). However, a small proportion of farmers, mostly in Kurunegala (63%), reported not using WI for any decisions, underscoring its overall importance in agricultural planning across the districts.
- The use of WI in farming operations enabled approximately 63 percent of paddy farmers in the sample to minimize crop losses resulting from climatic hazards such as droughts and floods. Additionally, around 48 percent of farmers reported achieving better resource management, including more efficient use of land, labour and agricultural inputs, by incorporating WI into their decision-making processes. These outcomes underscore the value of WI in enhancing the resilience of farming systems, optimizing resource allocation and mitigating the adverse effects of climate variability on agricultural productivity.
- In Anuradhapura, WI had the greatest impact on reducing crop losses with 39 percent of farmers reporting this benefit. It also contributed to increased crop yields (37%), improved resource management (31%) and decreased pest and disease outbreaks (30%). Similarly, in Kurunegala, WI showed significant positive effects across all areas, including enhanced crop yields (35%), better resource management (35%), reduced pest and disease outbreaks (34%) and lower crop losses (28%).
- *Pre-season meetings* held at each Agrarian Service Center (ASC) have been established as an institutional mechanism for the dissemination of WI. It was reported by nearly 80 percent of farmers that such meetings were conducted at their respective ASCs for the *yala* 2024 season. Approximately three-fourths of the sample of paddy farmers were reported to have participated in these meetings. The *pre-season meetings* were mainly attended by ARPAs, AIs and Agrarian

Divisional Officers (DOs) who serve as the heads of the ASCs. These meetings played a critical role in ensuring that farmers were informed and prepared for the season ahead, enhancing their capacity to make climate-responsive decisions.

- During the *pre-season meetings* held for *yala* 2024, decisions were primarily made concerning duration of land preparation, selection of crop varieties and harvesting date. Additionally, decisions were made regarding the timing of broadcasting or transplanting, release date for irrigated water, method and timetable for water distribution, threshing date, crop protection programmes and other traditional practices in paddy cultivation. These decisions were carefully planned to ensure optimal management of farming activities throughout the season.
- Regarding land preparation, it was stated by nearly half of the sample (49%) that the land preparation for *yala* 2024 was scheduled to take place in March, as decided during the *pre-season meetings*. This schedule was followed by 94 percent of the paddy farmers.
- Approximately 42 percent of farmers reported that the broadcasting or transplanting activities for *yala* 2024 were scheduled for March, as decided during the *pre-season meetings*. Notably, 96 percent of paddy farmers adhered to this plan.
- For *yala* 2024, around 38 percent of farmers indicated that harvesting/threshing was planned for July, based on decisions made during the *pre-season meetings*. This schedule was adhered to by 90 percent of the paddy farmers.
- Access to WI for farmers is influenced by factors such as internet availability, regional disparities, clarity of communication and information sources particularly media and peer networks. Strengthening digital infrastructure and improving digital literacy should be central to climate adaptation policies to ensure effective information dissemination. Additionally, tailoring distribution strategies to district-specific needs can enhance accessibility and relevance, making climate-related insights more impactful for farmers. Crucial factors influencing the extent to which WI helped farmers to make decisions in paddy cultivation include the clarity of WI, the perceived usefulness of the information, *pre-season* meetings and accessibility to information sources.

6.3 Recommendations

- Awareness should be created among agricultural extension officials on globally updated WI prediction software (Copernicus) to enable the provision of accurate and timely data. Such awareness equips them with the latest tools and knowledge to make informed decisions, improving resilience to climate variability.
- The existing government mechanism for WI dissemination should be strengthened by establishing direct linkages among Agrarian Service Centers (ASCs), the Department of Meteorology and the Natural Resource Management Centre of the

Department of Agriculture to ensure that information is disseminated accurately and on time.

- The promotion of WI dissemination should be facilitated through contact farmers, as they are better positioned to understand the needs of their fellow farmers. Their ability to convey information is often more effective than that of extension agents due to their familiarity with local challenges and shared experiences, ensuring that the information is delivered in a relatable and impactful manner.
- WI dissemination through digital platforms should be ensured to be easily accessible, understandable and provided in local languages.
- The dissemination of WI through digital platforms should be promoted by young, progressive farmers in the village. Their technological proficiency and ability to connect with fellow farmers make them well-suited to ensure that vital climate-related information is effectively shared within the community.

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APPENDICES

Appendix A: Sample Selection Areas

District	Irrigation System	ASC	Sample Size
Ampara	Rain-fed	Komari	22
		Panama	22
Anuradhapura	Rain-fed	Yakalla	21
		Koonwewa	23
Anuradhapura	Minor irrigation	Yakalla	24
		Palugaswewa	25
		Galenbindunuwewa	28
		Horowpothana	26
		Vantharumoolai	16
Batticaloa	Rain-fed	Kiran	17
		Eravur	16
		Karadiyanaru	16
		Valachchenai	15
		Ehetuwewa	32
Kurunegala	Rain-fed	Galgamuwa	25
		Ehetuwewa	20
Kurunegala	Minor irrigation	Galgamuwa	25
		Ganewatta	12
		Rambe	20
		Kanakarayankulam	14
Vavuniya	Minor irrigation	Kovilkulam	15
		Nedunkerny	6
		Omanthai	5
		Total	445

Appendix B: Other Information of Principal Farmer in the Sample

Parameter	Frequency	% of Farmers
Household Size		
1-3	177	40
4-6	254	57
7-9	14	3
Total	445	100
Number of Adult Males Engaged in Farming		
1	348	82
2	66	15
>2	12	3
Total	426	100
Number of Adult Females Engaged in Farming		
1	231	81
2	44	15
>2	7	2
Total	282	100
Children (12-18 yrs.) Engaged in Farming		
1	29	54
2	18	33
>2	7	13
Total	54	100
Principal Farmers' Engagement in Agriculture		
Full time	349	78
Part time	96	22
Total	445	100
Share of Income Received from Agriculture to the Total Household Income		
1-20 %	33	7
21-40 %	75	17
41-60 %	105	24
61-80 %	58	13
81-100 %	174	39
Total	445	100
Farming Experience of Principal Farmer		
Less than 10 years	38	9
10-20 years	139	31
21-30 years	120	27
31-40 years	97	22
More than 40 years	51	11
Total	445	100

Source: HARTI Survey Data, 2024.

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