Impacts of shocks and coping strategies of vegetable farm households in Sri Lanka during COVID-19 pandemic

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Abstract

Over time, smallholders in developing countries, including those in Sri Lanka, face a variety of shocks and develop coping strategies in response. The COVID-19 pandemic resulted in a novel shock to many farm households in developing countries, often negatively impacting their livelihoods. This exploratory qualitative case study provides a comprehensive study on the impact of the pandemic on Sri Lankan smallholder vegetable farm households and their coping strategies. Data were collected from vegetable farm households and key informants in Nuwaraeliya and Kandy districts, mainly using the interview method and data were analysed qualitatively.

Vegetable farm households in Sri Lanka faced multiple, diverse shocks characterised by cumulative, consecutive, interrelated, and ongoing events during the pandemic. This mix of shocks resulted in various impacts on vegetable farm households, but the common outcome on all households was financial due, in the main, to increased household costs and decreased household income. Farm households that predominantly depended on income from vegetable selling and farm households that produced only specialised types of vegetables for specialised markets were more adversely affected than others.

Smallholder vegetable farm households were diverse in circumstances, production and marketing systems, household capitals, reliance on vegetables as an income source and livelihood activity. At any point in time different strategies related to production, marketing and financial hardships were being used by farm households to respond to the impacts of shocks they experienced. However, there was no consistent mix of strategies. The poorest continued to borrow, while others relied on savings and assets and then started to borrow when resources were depleted. How similar strategies were implemented varied across households depending on the social networks of households.

While acknowledging the benefit of diversification for farm households during shocks, this study also illustrates that diversification does not guarantee that it will support farm households in buffering the impacts during a wide-scale shock that extends over a long period. However, market diversification supports farm households to buffer the impacts of shocks with broad-scale impacts. This study also identified the significance of individual household members' personal characteristics such as motivation and enthusiasm in developing strategies and argues for including this attribute in human capital in the sustainable livelihood framework.

Research insights strongly suggest that interventions intended to support farm households in buffering the impacts of shocks need to focus on the household level, prioritising the poorest of the poor while remaining open to addressing the needs of other farm households who might be wealthier but adversely affected by shocks. Providing direct financial support and implementing different financial services to accommodate the varied circumstances of farm households will benefit them during shocks. Interventions to build household and local community resilience will safeguard farm households as it will exclude the risk of overreliance on external government support.

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List of Acronyms

DAD	Department of Agrarian Development
DoA	Department of Agriculture
AI	Agricultural Instructor
ARPA	Agricultural Research and Production Assistant
COVID-19	Coronavirus disease
DS	Divisional secretariat
GAP	Good Agricultural Practices
GND	Grama Niladhari Divisions
Rs	Sri Lankan Rupees
SLF	Sustainable Livelihood Framework
WHO	World Health Organisation
GNI	Gross National Income

1) INTRODUCTION

1.1 Introduction

Over time, farm households, including those in Sri Lanka, face a variety of shocks (Dekker, 2004), to which they create a range of coping strategies (Ngenoh et al., 2018; Zseleczky & Yosef, 2014). Extreme climatic events and sudden pest attacks are examples of these types of shocks, and in recent times, the COVID-19 pandemic has added to and exacerbated these shocks, adversely impacting many farmers in developing countries (Adhikari et al., 2021; Balana et al., 2022; Tripathi et al., 2021).

COVID-19 is an infectious respiratory disease caused by the coronavirus 2 (SARS-CoV-2) (WHO, 2023a) that is assumed to have originated in the Wuhan region of China in December 2019. The virus spread rapidly worldwide, and in March 2020, the WHO declared COVID-19 a global pandemic. Several measures, such as social distancing, international and national border closures, lockdowns, mandatory hygienic practices like mask-wearing and hand washing, and finally, COVID-19 vaccination programs, were implemented to control the virus spread. Despite these measures, according to the WHO data as of October 4 2023, there had been about 770 million (771,151,224) confirmed cases of COVID-19, including about 6.9 million (6,960,783) deaths reported worldwide (WHO, 2023b).

The world experienced the complex and interrelated consequences of this fatal COVID-19 pandemic. The pandemic, directly and indirectly, impacted the individual, household, community, district, regional, national, and international levels (Balana et al., 2023; Talukder et al., 2021). Although significant shocks have occurred in the world recently, including economic crises (e.g. 2008 food price hikes), disease outbreaks (e.g. Ebola in Africa) and pest attacks (e.g. locust invasion in eastern Africa), unlike the COVID-19 pandemic these shocks were restricted to only parts of the world (Bisoffi et al., 2021). COVID-19 spread worldwide in a relatively limited time, widely affecting society irrespective of socio-economic status or geographic location (Bisoffi et al., 2021). Agriculture sectors were likewise impacted with farm households, including smallholders in developing countries, struggling to access

inputs and markets for their agricultural products due to supply chain disruptions, domestic and international travel restrictions, and market closures during the pandemic period (Adhikari et al., 2021; Bitzer et al., 2024; Menon & Schmidt-Vogt, 2022; Middendorf et al., 2022; Tripathi et al., 2021).

The first confirmed case of COVID-19 in Sri Lanka was identified in January 2020 from a non-Sri Lankan national (Amaratunga et al., 2020), and the pandemic gradually surged on the island thereafter. The government of Sri Lanka mainly adopted a proactive approach to respond to the pandemic, which included a partial or complete shutdown of the main social and economic activities in the country (Amaratunga et al., 2020; Hettiarachchi et al., 2020). Although details of the national-level response to the pandemic is well documented (Amaratunga et al., 2020; Hettiarachchi et al., 2020), little attention has been given to the impacts and responses of smallholder farm households in Sri Lanka. This study addresses this deficit by exploring the impacts of the COVID-19 pandemic on vegetable farm households in Sri Lanka, and how they responded. What emerged was that COVID-19 did not occur in isolation from other ongoing shocks and because of the pandemic, various shocks emerged at different times. Therefore, this study investigates the impact of multiple shocks (including those directly and indirectly related to the COVID-19 pandemic) on vegetable farm households during the pandemic.

An exploratory qualitative case study was undertaken with primary data collected from vegetable farm households and key informants who were knowledgeable of vegetable farm households and their vegetable production and marketing processes. The sustainable livelihood approach (DFID, 1999; Scoones, 1998b) framed this study to identify and describe the coping strategies of vegetable farm households during the pandemic period. This research captures the impacts of multiple shocks on vegetable farm households during the pandemic, their coping strategies, and the factors affecting their coping strategies. The smallholder vegetable farm households included in this study will be referred to as farm households hereafter.

The research context for this study was Sri Lanka during the COVID-19 pandemic. The characteristics of this context are outlined in the next sections.

1.2 Research context: Sri Lanka and COVID-19

Sri Lanka is an island nation located within the tropics between 5° 55' to 9° 51' North latitude and between 79° 42' to 81° 53' East longitude with a geographical area of 65,610 km^2 and a total population of around 22,181,000 (Central Bank, 2022; Department of Census and Statistics, 2023b; Department of Meteorology, 2023). Sri Lanka has a tropical climate and its annual rainfall varies from less than 900 mm (in the driest areas) to over 5000 mm (in the wettest areas)(Department of Meteorology, 2023). The mean annual temperature varies with the topography and can vary from 27°C in the coastal lowlands to 16°C in the central highlands (Department of Meteorology, 2023). The administrative divisions of Sri Lanka includes nine provinces and 25 districts.

With its GDP of Sri Lankan rupees (Rs.) billion 24,148, Sri Lanka has been categorised as a lower-middle-income country[1] in the World Bank classifications (Central Bank, 2022; World Bank, 2023). Agriculture, industry, and services (e.g. finances, health) are the main economic sectors in Sri Lanka, with 26.5%, 26.5%, and 47.0% of the employed population involved in agriculture, industries, and service sectors, respectively (Department of Census and Statistics, 2022b).

The agriculture, forestry, and fishing sectors collectively contribute 7.5% to the national GDP of Sri Lanka (Central Bank, 2022). Rice is the staple food crop cultivated as a main crop, followed by horticultural crops (e.g., fruits, vegetables), field crops (e.g., maize, big onion), plantation crops (e.g., tea, rubber, coconut), and minor-export crops (e.g., cinnamon, pepper)(Rosairo, 2023). The livestock sector includes rearing cattle, buffaloes, sheep, pigs, goats, and poultry and there are more than

[1] For the 2024 fiscal year, lower middle-income countries are countries with a GNI per capita between $1,136 and $4,465 (World Bank. (2023). *World Bank Country and Lending Groups*. World Bank Group. Retrieved 11/10/2023 from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

600,000 registered livestock farmers, the majority being small-scale farmers (Mombauer & Wijenayake, 2020).

The climate in Sri Lanka depends on monsoon rains because of its geographical location in the Indian Ocean. There are two primary crop cultivation seasons in Sri Lanka based on the seasonal variation of the rainfall: Yala and Maha. Yala season is from May to September, which brings the southwest monsoon (summer monsoon), and Maha season is from December to February, which brings the northeast monsoon (winter monsoon) (Thevakaran et al., 2019). The lowland areas in the southwestern part of Sri Lanka and the western slopes of the hill country receive heavy rainfall during the Yala season, while the northern and eastern parts of the country receive heavy rains during the Maha season (Thevakaran et al., 2019). The period in between these two primary seasons is identified as inter-monsoonal seasons (Thevakaran et al., 2019). The first inter-monsoonal season is from March to April, and the second inter- monsoonal season is from October to November (Jeyadharushan & Nandakumar, 2012; Naveendrakumar et al., 2018). In the first inter-monsoonal season, the southwestern parts of the hill country receive heavy rains. In contrast, in the second inter-monsoonal season, all parts of the country receive balanced tropical rainfall (Jeyadharushan & Nandakumar, 2012; Punyawardena, 2020).

1.3 Overview of vegetable production and marketing in Sri Lanka

Vegetables are a main horticultural crop in Sri Lanka. Favourable agro-climatic conditions allow farmers to grow around 40 varieties of vegetables year-round in Sri Lanka (Weerakkody & Mawalagedera, 2020). The types of vegetables produced are broadly categorised as up-country[2]vegetables (temperate vegetables, (e.g., carrots, beetroot, leeks, cabbage) and low-country vegetables (tropical vegetables,

[2] The geographical classification in Sri Lanka (based on the elevation)is named as upcountry(>900m),mid country (300-900m) and low country (<300m)Punyawardena, B. V. R. (2020). Climate. In R. B. Mapa (Ed.), *The Soils of Sri Lanka* (pp. 13-22). Springer International Publishing. https://doi.org/10.1007/978-3-030-44144-9_2 .

e.g., brinjal, pumpkin, snake gourd, bitter gourd) (Department of Agriculture, 2022). The vegetable sector provides an essential source of livelihood for many Sri Lankan farm households (Weerakkody & Mawalagedera, 2020). Most vegetable producers are poor, smallholder farmers with relatively low household income and limited access to owned land, credit and financial facilities.

Vegetable production in Sri Lanka is labour-intensive (Central Bank Sri Lanka, 2020b). For example, in the Nuwaraeliya district, cultivating 0.4 ha of carrots requires 121 person days, whereas in the Kandy district, cultivating 0.4 ha of land for tomatoes requires 140 person days (Socio Economics and Planning Centre, 2022). The vegetable sector also claims to have a higher usage of hybrid seeds and imported synthetic fertilisers than other crops (Weerakkody & Mawalagedera, 2020). An empirical study conducted in the dry zone[3] of Sri Lanka found that the Murate of Potash (MOP)(a source of Potassium) application rate in vegetables was 170kg/ha, while it was 50 kg/ha and 55kg/ha in paddy and maize, respectively (Weerahewa & Dayananda, 2023). Many of these chemical fertilisers are imported (Weerahewa et al., 2010). Sri Lanka imported 574,705.9 MTs of chemical fertiliser in 2020, which cost more than Rs.36 billion (Ministry of Agriculture and Plantation Industries, 2024).

The vegetable sector directly contributes to the national economy. The local marketing channels for vegetables are diverse and dominated by the private sector (Sandika, 2012). In 2018, Sri Lanka exported 25,765 MTs of vegetables worth Rs. million 4,595 to overseas markets (Central Bank Sri Lanka, 2019).

In contrast to rice (paddy) farmers, vegetable farm households in Sri Lanka face challenges such as the absence of a guaranteed price for vegetables, little access to community irrigation systems (unlike the paddy sector), limited access to reliable information sources, high transaction costs in marketing and

[3] Dry Zone' covers the Northern, North Central, Eastern and South-Eastern plains of the country and receives a mean annual rainfall of less than 1750 mm Sirisena, D., & Suriyagoda, L. D. (2018). Toward sustainable phosphorus management in Sri Lankan rice and vegetable-based cropping systems: A review. *Agriculture and Natural Resources*, *52*(1), 9-15. https://doi.org/https://doi.org/10.1016/j.anres.2018.03.004

a lack of input subsidies (De Silva & Ratnadiwakara, 2010; Perampalam & Perera, 2018; Sandika, 2011). Compared to many other food crops, the perishable nature of vegetables makes them a complex product to manage post-harvest if the supply chain is disrupted (Hailu and Derbew, 2015). Vegetables require immediate transport to markets before they deteriorate and need timely marketing (Sandika, 2012). In Sri Lanka, vegetable marketing is governed mainly by the private sector, with a significant involvement of middlemen at different levels in the value chain. Therefore, vegetables lack guaranteed prices, and profit margins are relatively low and unpredictable (Sandika, 2011). This uncertainty makes vegetable farm households potentially more vulnerable to shocks than those who do not face these problems.

Considering the nutritional and economic importance of vegetable production and the relative vulnerability of smallholder vegetable producers in Sri Lanka, vegetable farm households are the focus of this research. This study expands the work of a small number of studies (Bandara et al., 2022; Mahaliyanaarachchi et al., 2020; Rathnayaka et al., 2023) and explores how Sri Lankan vegetable farm households were impacted during the COVID-19 pandemic and their responses to those impacts.

1.4 Aim of the study, research question, and research objectives

This study aims to contribute to informing policy directed at providing government support for smallholder farmers in Sri Lanka and policy directed at enhancing smallholder resilience and livelihoods. This study answers the research question: How did Sri Lankan vegetable farm households respond to the impacts of the COVID-19 pandemic, and why?

This research question was answered through two research objectives:

-To identify and describe the impacts that COVID-19 had on vegetable farmers and their households in Sri Lanka and why.

-To identify and describe the strategies the Sri Lankan vegetable farmers and their households have adopted to cope with shocks during the COVID-19 period and why.

1.5 Thesis structure

This thesis consists of seven chapters. The Introduction chapter presents the background information, including the research context, aims, question and objectives. The second chapter of the literature review presents and critically analyses normative and empirical literature on shocks faced by households, their coping strategies, and the household capital affecting coping strategies. Chapter three presents the research design, strategy, data collection and analytical process, and ethical considerations. Chapter four - case description, describes the case study sites and characteristics of the vegetable farm households involved in this study. Chapter five presents the findings on the impact of shocks on vegetable farm households and their coping strategies. Chapter Six discusses the significance of the findings and highlights this study's contribution to the existing body of knowledge. Finally, chapter seven provides conclusions to this study, practical implications of this study, reflections on research design and suggestions for future research.

The next chapter will present the theoretical and empirical literature related to shocks and coping strategies of households.

2) LITERATURE REVIEW

2.1 Introduction

This study aimed to investigate the impact of shocks on vegetable farm households in Sri Lanka during the COVID-19 pandemic and to understand how vegetable farm households responded to these impacts. In this research, a system perspective was followed because the study interest was to have a holistic understanding of the households and what shapes the impacts and strategies of those households as a whole instead of simply exploring the relationship between strategy and the impacts of shocks. Therefore, this section of the literature review aims to review how and why different scholars identify and categorise shocks and coping strategies and the factors that enabled or constrained farm households' ability to respond to shocks. This review was conducted to inform the analysis, results, and findings of this research.

This chapter reviews the literature relevant to the study and is separated into three main sections. Following the introduction, section 2.2. will review the literature on shocks. It will review how shocks on households have been identified and categorised. Section 2.3 will review the literature on the coping strategies of households. The literature on household capital and its importance in relation to how well households cope with shocks will be reviewed in section 2.4. Then section 2.5 will review the literature on the impacts and coping strategies of smallholder farm households during the COVID-19 pandemic. Finally, in section 2.6, a summary of the chapter and some identified gaps in the literature will be provided.

2.2 Shocks faced by households

Farmers worldwide face different types of shocks as inseparable aspects of farming (Chuang, 2019; Kom et al., 2022; Nguyen et al., 2022; Spiegel et al., 2021; Tan et al., 2021). This study explores the multiple shocks that impacted smallholder vegetable farm households during the COVID-19 pandemic

in Sri Lanka. Many scholars identified the COVID-19 pandemic as a shock (Kind, 2020; Upton et al., 2023; Yazdanpanah et al., 2021). However, COVID-19 seems to be one of multiple shocks across different scales and time frames during this period. This study was conducted to understand the impacts of shocks on smallholder vegetable farm households in Sri Lanka and their coping strategies for the impacts of these shocks. Because this study focuses on the household level, the literature review will primarily draw on the livelihood literature, which has a household-level focus (Chambers & Conway, 1992; De Haan & Zoomers, 2003, 2005). However, other literature will be drawn on where relevant to help understand the impact of shocks on smallholder farm households and the coping strategies such households might use to cope with impacts of shocks.

Scholars from different disciplines refer to shocks using a range of different terms. Shocks have been identified as risks in the farm management literature (Hardaker et al., 2015), perturbations in socio-ecological studies (Oliver et al., 2015) and rapid and turbulent changes in farm system studies (Darnhofer, 2010; Darnhofer et al., 2016). The main interest of this study is to understand the farm households' experiences and responses to the shocks that occurred during the pandemic. Most of the households in this study are subsistence farm households whose primary motive is to survive rather than to perform as a business. Therefore, this study does not view farm households as profit-oriented rational economic units or single units of a holistic socio-ecological system.

In the livelihood literature, scholars tend to identify types of shocks at the household level in different ways, and it is highly context-specific (Gloede et al., 2015; Haq, 2015; Rashid et al., 2006). The identification of shocks seems to also depend on the research interests and research objectives of these studies. Understanding different explanations of shocks in households will be helpful to explore the nature of shocks that occur during the COVID-19 pandemic.

The literature identified households experience different types of shocks at different times. Since the household provides the basis for this review, the following section will review how ‘household’ has been identified in the literature.

2.2.1 Defining a household

The definition of the term household varies among scholars. However, there are common features attributed to the description of a household. Livelihood researchers suggest a household is a 'human group which shares the same hearth for cooking' (Chamber & Conway, 1992, p. 6). This seems a straightforward, unidimensional definition of a household. Geiselhart (2018) argues that the sustainable livelihood approach does not clearly define the term "household". He further contends that individuals in a household do not contribute in the same way to achieve household objectives, and a household is characterised by intra-household communication, the relocation of resources and the performance of work (Geiselhart, 2018). According to Geiselhart (2018), a household can be viewed as a 'particular form of partnership or joint practice between members of a group to achieve a certain goal to the benefit of those involved', which is represented by the explanation of the term household by Sozietät (p. 71). This definition does not necessarily mean a household is only a 'family'. This is supported by the work of Wheelock (1996), who argued that a household may be characterised by individuals with different relationships depending on the context. They have opportunities and constraints as individuals, members of the household, and external society (Wheelock & Oughton, 1996). According to Niehof (2004), a household is 'a family-based co-residential unit that takes care of resource management and the primary needs of its members' (p 323). Niehof brings the idea of 'family' to the definition of a household. However, 'residence' in Niehof's definition does not necessarily mean living under one roof but sharing household resources in some way to meet their needs (Niehof, 2004).

There is a lack of clarity on the definition of household in the livelihood literature, and it also does not fully acknowledge dynamics within the households. Giving constructive criticism on the livelihood approach, some scholars argue that to gain a better picture of the household, it is also necessary to consider power dimensions (e.g. gender, ownership of land) within a given household during the

household analysis (Levine, 2014; Shibata et al., 2020; Spencer-Wood, 2004) which is lacking in many livelihood studies. This urges the need to draw from other relevant literature to understand the household concept.

For example, for economists, the household is viewed as a domestic unit where a 'coresident group of persons who share most aspects of consumption, drawing on and allocating a common pool of resources (including labour) (Schmink, 1984, p 89). This definition used co-residence, sharing resources and consumption in a household. This definition is also aligned with other economics scholars who view the household as the crucial unit for consumption and labour supply decisions (Wheelock & Elizabeth, 1996), especially on small-scale farms (Hossain et al., 2023; Roberts, 1991). Living together and working towards a common economic purpose seem to be parameters used by these scholars to identify a household. The livelihood literature does not use these characteristics together to define a household. However, these ideas seem challenged because, with globalisation, sometimes household members live far from each other, making co-residence impractical but still contributing to the household economy (Kaag, 2004). For example, many livelihood studies suggest that members of farm households move away from the farm to work as labourers in other regions or countries of the world (Burnham & Ma, 2016; Davis & Lopez-Carr, 2014; Kabir et al., 2017; Sujakhu et al., 2016). This aligns with the definition by Niehof (2004), who identified that co-residence is not always possible. Therefore, definitions from economics identify households as basic decision-making units in society.

Anthropologists view households as 'the basic unit of society in which the activities of production, reproduction, consumption and the socialisation of children take place' (Roberts, 1991, p. 62). This definition does not necessarily acknowledge co-residence, as explained by economists, and it also does not recognise marriage and kinship as the only ways to recruit to a household (Roberts, 1991). Nevertheless, the socialisation of children seems to be an element in explaining a household in anthropology. These definitions in economics and sociology imply households are meant to meet

economic and social needs. Household implies the basic social unit where resources are shared and reproduced, children are socialised, and decisions on consumption and labour allocation are made.

A household has essential functions, as explained in the definitions above. These essential functions of a household seem to be captured by government documents in different ways when they design and implement national-level studies. For example, the Ghana Living Standard survey defined a household 'as a person or group of related or unrelated persons who live together in the same housing unit, sharing the same housekeeping and cooking arrangements and are considered as one unit, who acknowledge an adult male or female as the head of the household' (Ghana Statistical Service, 2006 p 04). The same types of elements have been captured by the household income and expenditure survey 2019 in Sri Lanka, which considers households as units where one person lives by him/herself with separate arrangements for cooking or purchasing food or units where two or more persons living together and have a common arrangement for the provision of food (Department of Census and Statistics, 2019). Sharing common shelter and cooking arrangements emerges as a common determinant of a household. Nevertheless, its household members decide the composition of a household based on their mutual interactions in meeting individual and household needs. Therefore, for this study, a household was taken to be whatever the collection of individuals or units the respondents took it to be.

This study investigated the impact of shocks during the COVID-19 pandemic period at the household level. Taking households as a unit of analysis to understand the impact of shocks in this study had several conceptual and empirical advantages. Collecting data at the household level in this study was beneficial to better understand the impact of multiple shocks during the pandemic on households and their interactions with the broader community. Focusing on households enabled the researcher to identify the intra-household changes during the pandemic and how they are being shaped by the factors external to the household. The household level was the grassroots level of interest for this study; therefore, it was convenient to capture the impact of the sudden pandemic, and it will also be

helpful to make inferences on the broader level. This is supported by Schmink (1984), who argues that the household is a more convenient unit of empirical data collection and that the analysis of the household would serve as an intermediate level of analysis that bridges the understanding between the individual and macro level contexts (Schmink, 1984).

This study investigated smallholder farmer households; the next section will review smallholders.

2.2.2 Defining smallholders

There is no universally accepted definition for smallholders (Bosc et al., 2013; Morton, 2007). Instead, definition of smallholders changes with the context (Kamara et al., 2019; Morton, 2007). Scholars have used different parameters such as land size, labour, resource endowment, technology and market orientation to identify smallholders (Kamara et al., 2019).

Smallholder farmers are frequently defined based on the size of their cultivated land. Many scholars have identified smallholders as farmers who produce less than 2.0 ha of land (Fan & Rue, 2020; Giller et al., 2021; Lowder et al., 2016; Ricciardi et al., 2018). However, different studies have used different land areas to identify smallholder farmers. For example, a study conducted by Mugwe (2009) on the integrated soil management practices of smallholder farmers in the central highlands of Kenya defined smallholder farms as those with a land area that ranged from 0.1 to 3.0 ha with an average area of 1.2 ha. In contrast, another study in the Amazon basin defined smallholders as farmers who cultivate less than 200 ha of land (Davidson et al., 2012). These two examples show that the land area researchers use to define smallholders can vary considerably depending on the local context. In one context, a smallholder farm may be 3.0 ha or less in area, but in another context, it may be 200 ha or less in area. Therefore, using a single parameter does not fit to define smallholders in general. If farm area is used to define smallholders, it depends on what is considered "small" in the context one is researching. For example, a definition based only on the land size might also vary between developed and developing

countries, as smallholders in developed countries might have much bigger land sizes than smallholders in developing countries (Morton, 2007). Labour use has been used by Morton (2017) to define smallholders, and he argues that smallholders are farmers who mainly use family labour and primarily depend on farms for income. However, many farmers in New Zealand are not smallholders even though they mainly use family labour.

In the literature, the term 'smallholders' is used interchangeably with the term subsistence farmers (Kamara et al., 2019; Morton, 2007) or peasants (Cousins, 2010; Wharton, 2017). The primary goal of production by subsistence farmers is to provide food for the family rather than produce for the market (Wharton, 2017). Different factors might affect farmers' decisions whether to use their produce for household consumption or to sell. Therefore, farmers exhibit various degrees of subsistence and commercialisation. Therefore, defining smallholders is highly contextual because of this diversity in subsistence and commercialisation. Based on that, Morton (2007) argued that subsistence and smallholder farmers lie in the continuum between subsistence and market-oriented production.

Incorporating land size and dependence on vegetables as a source of household income, this study defines smallholders as farmers who cultivate vegetables in less than 2.0 ha of land and depend on vegetable farming as a primary source of household income. The scope of this study is to identify the impact of shocks and coping strategies on farm households; therefore, the following section will review shocks.

2.2.3 Defining and characterising shocks

Different scholars in livelihood literature have researched shocks on households and have been defined differently. Other scholars have differentiated the types of shocks, whereas some do not distinguish the types of shocks (Cohn et al., 2017; Darnhofer, 2010). The probable reason for this is that their primary focus is on the general impact of shocks that take place during a given period but not trying

to characterise the shocks. In contrast, the scholars whose intention was to explore deeply the characteristics and impacts of shocks tend to classify different shocks, very often based on the scale of the impact; for example, whether the shock affects a single household or more than one household (Nguyen et al., 2020; OECD, 2014). Shocks that affect agroecosystem sustainability were introduced by Conway (1987), and later, shocks on households related to sustainable livelihoods were discussed by Scoones (1998).

The theory of sustainable livelihoods was developed in the context of the international development approach, and one of the purposes of developing this idea was to maximise the effectiveness of development practitioners' interventions for the disadvantaged (Morse & McNamara, 2013). Therefore, the theory of sustainable livelihoods helps to understand the livelihoods of poor people and places poor people at the centre of development policies and agendas (De Haan & Zoomers, 2005; Rakodi, 2014; Twigg, 2001). The concept of sustainable livelihoods views people as operating in vulnerable contexts consisting of shocks, trends, and seasonality (Twigg, 2001).

The early work on shocks in the sustainable livelihoods literature (Chambers & Conway, 1992) drew on the work by Conway (1987), where he set out the properties of agroecosystems as a framework for evaluating the performance of agricultural development programmes and projects. Conway (1987, p. 101) defined the sustainability of an agroecosystem as its ability "to maintain productivity when subject to a major disturbing force". Conway (1987) argued that such a "disturbance" might take two forms. The disturbance may be caused by intensive stress, where stress is defined as "*a frequent, sometimes continuous, relatively small and predictable disturbing force which has a large cumulative effect*" (p. 101). In contrast, the disturbance may be caused by a shock, which Conway (1987, p.102) defined as "*an infrequent, relatively large and unpredictable disturbing force which has the potential of creating an immediate, large disturbance or perturbation*".

Analysis of Conway's (1987) definition of shocks showed that Conway differentiated between the shock's nature and the shock's impact, using four dimensions: frequency, scale, predictability and the

temporal nature of the impact of the shock (See Table 2.1). He used these criteria to distinguish between shocks and stresses. The nature of shocks tended to be infrequent, relatively large, and unpredictable. In contrast, the nature of stresses tended to be frequent, sometimes continuous, relatively small, and predictable. In terms of the temporal nature of the impact, shocks tended to create an immediate, large disturbance (e.g., rare drought or flood, new pest, sudden rise in input price), and stresses had a large and prolonged cumulative effect over time (e.g. salinity, toxicity, erosion) (Conway, 1987).

Conway's (1987) work was used in the discussion paper on 'sustainable rural livelihoods: practical concepts for the 21st century' by Chambers and Conway (1992) to differentiate between the stresses and shocks impacting rural households. According to the analysis of definitions by Chambers and Conway (1992), they used four dimensions to classify shocks: 1) the nature of the shock, 2) the duration of the shock, 3) the predictability of the shock and 4) the scale of the impact of the shock (Chambers & Conway, 1992). In contrast to Conway (1987), Chambers and Conway (1992) used the scale of the impact from a shock (distressing or traumatic) to differentiate shocks. Chambers and Conway (1992) indicated that some shocks build up gradually, such as declining labour work, declining available yield due to soil erosion, and population pressures on resources leading to declining farm size. They also stated that regularly occurring shocks can arise from cycles that may be diurnal (e.g., midday and afternoon heat, mosquitoes in the evening and night) or seasonal (Chambers & Conway, 1992) and that seasonal cycles tend to have a more significant impact. Chambers and Conway (1992) also distinguished between shocks that impacted whole communities (e.g., war, drought, famine, floods, epidemics) and those that impacted a single household or individual (e.g., sudden illness, death of a family member, theft, loss of a job).

Scoones (1998) built on the work of Chambers and Conway (1992) and provided a framework for analysing sustainable livelihoods. Scoones (1998) used the exact four dimensions Conway (1987) set out to differentiate between what he also termed shocks and stresses. The dimensions include the

characteristics of the shock and the impact of the shock. The four dimensions are magnitude/scale, frequency, predictability, and the temporal nature of the impact of the shock (Scoones, 1998b) (See Table 2.1). Interestingly, the scale of the impact from a shock was not counted in differentiating shocks by Scoones. Table 2.1 illustrates different dimensions used by different scholars to categorise shocks.

Table 2-1: Different dimensions and categorisation of shocks

Focus	Dimensions	Aspects		Source
		Shock	Stress	
Shock Characteristics	Scale	Large	Small	Conway, 1987; Scoones, 1998
		Single household or more than one household		Gloede et al. 2015
	Frequency	Infrequent	Frequent/ Regular	Conway, 1987; Scoones, 1998
	Predictability	Unpredictable	Predictable	Conway, 1987; Scoones, 1998: Gloede et al. 2015
	Nature	Force	Pressure	Chambers & Conway, 1992; Conway & Barbier, 2009
	Type	Demographic, social, agricultural, economic		Gloede et al. 2015
Impact characteristics	Temporal nature	Immediate	Cumulative	Conway, 1987; Scoones, 1998
	Duration	Sudden	Continuous/ Cumulative	Chambers & Conway, 1992
	Scale	Traumatic	Distressing	Chambers & Conway, 1992
		High, Medium, Low		Gloede et al. 2015

Sources: (Chambers & Conway, 1992; Conway & Barbier, 2009; Conway, 1987; Gloede et al., 2015; Scoones, 1998a)

According to Conway & Barbier (2009), shocks are unpredictable, large forces, and the work of Conway (1987) and Conway & Barbier (1990, as cited in Chambers and Conway, 1992) identified stresses as pressures. This differentiation may be explained using definitions of 'force' and 'pressure' in physics. The interaction between two objects causes a force, either a push or pull, with a magnitude and direction (Chaichian et al., 2021). A force might change the status of an object on which it is exerted. Conway & Barbier (2009) identified when a shock affects an agricultural production system[4], it changes its status. Similarly, pressure denotes the continuous pressing or pushing of the object on which it applies. The work of Conway (1987) and Conway & Barbier (1990, as cited in Chambers and Conway, 1992) identified stresses as pressures because those shocks create a continuous push on households over an extended period of time.

Early studies on shocks were interested in explaining shocks as a dichotomy of shocks and stress. However, the nature of these shocks (or stress) had not been adequately described, and there was also no detailed classification of shocks.

Chambers and Conway's (1992) categorisation acknowledged that shocks would create an impact on individual households (e.g., accidents, sudden illness, death of a family member or valued animal, loss of assets, loss of jobs) or communities (e.g., civil violence, drought, storms, floods, fire, epidemics). Scoones' (1998) classification categorises the nature of the impact of a shock as immediate and cumulative. Both Chambers & Conway and Scoones identified the nature of the impact of shocks in a simplistic way. These definitions do not identify how the impacts of shocks could vary with other factors such as time or policies. This definition also does not acknowledge whether a shock can create different and multiple impacts. A clear cause-and-effect relationship could not be observed when

[4] Conway & Barbier's (2009) study is based on the sustainability in agricultural production system which consists of resources, international and national policies, national economies and individual livelihoods (See Conway & Barbier's ,2009)

scholars explain shocks and their impact. However, according to Kaag (2004), people face different shocks, and the causes and consequences often cannot be separated (Kaag, 2004, p 7). Like Scoones (1998), Gloede et al. (2015) also used four dimensions to categorise shocks in a comprehensive study on shocks and vulnerability in poor rural households in Northeast Thailand and Vietnam. In contrast to Scoones (1998), Gloede et al. (2015) recognised a three-stage significance of impact (i.e. high, medium, low) at the household level. Unlike previous work, Gloede's classification helps understand the scale of the impacts. Like Scoones (1998), Gloede et al. (2015) differentiated shocks based on predictability and scale. Whereas Gloede et al. (2015) also identified types of shocks, Scoones (1998) included frequency and various impact characteristics.

Other scholars recognise that shocks in households differ in frequency, duration, and scale, as well as the magnitude of the impact of the shock. Therefore, similar to Scoones (1998), the Poverty and Economic Policy-Community Based Monitoring System (PEP-CBMS) Network Coordinating Team (2011) recognised household shocks differ based on duration (one-off < ---- >persistent), scale (limited < ---- > widespread), and frequency (common <----> rare) (PEP-CBMS Network Coordinating Team, 2011). But it does not recognise Scoones (1998) dimension of the temporal nature of the impact of the shock. Like Gloede et al. (2015) and Chambers & Conway (1992), the PEP-CBMS Network Coordinating Team recognises the dimension of impact intensity (mild <----> catastrophic). Scoones (1998) has a simple dichotomy between shocks and stresses that capture one aspect of four dimensions of shocks (i.e., the shock's nature, the shock's duration, the predictability of the shock and the scale of the impact of the shock). PEP-CBMS Network Coordinating Team (2011) identifies four dimensions of shocks, but they do not differentiate shocks based on a specific mix of dimension aspects. Instead, it highlights the diversity of shocks and recognises that at any point in time, households may experience multiple diverse shocks. This contributes significantly to the literature on shocks because it acknowledges shocks on households can be hugely diverse.

A significant development made by the PEP-CBMS Network Coordinating Team (2011) was that they rejected the use of simple two-aspect distinction of dimensions used by Scoones (1998) and others (e.g., Conway, 1987; Chambers and Conway, 1992) that classified a disturbance as a stress or shock. PEP-CBMS Network Coordinating Team suggests that this was too simplistic and that, in reality, shocks might sit along a continuum of these criteria. For example, whereas Scoones (1998) distinguished between infrequent and regular as the criteria for the frequency dimension of a shock, PEP-CBMS Network Coordinating Team (2011) specified a continuum that ranged from common to rare for the frequency dimension.

The use of a single dimension to characterise shocks is also evident in literature. Some scholars only used the scale to differentiate shocks (Béné & Devereux, 2023; de Janvry et al., 2014; Dercon, 2002; Haq, 2015; OECD, 2014; PEP-CBMS Network Coordinating Team, 2011; Pradhan & Mukherjee, 2018). For example, in recognising different kinds of shocks, the OECD (2014) categorised shocks based on the scale of the shock, which distinguishes between shocks that impact a single household (e.g., death, injury, job loss of a family member, crop failure) and those that impact more than one household. Chambers and Conway (1992) also differentiated between shocks on a community and a household or individual, but they also included the other characteristics. This distinction based only on scale (single household versus multiple households) has been criticised for not reflecting the complexity reported from empirical studies (Heltberg et al., 2015) because some shocks can impact households and communities. The studies which argue that shocks can be classified into two categories based on the scale of the impact are primarily concerned with investigating the differences between the impact of a shock, factors affecting the impact, and coping strategies by one household or more than one household during shocks (Debebe et al., 2013; Dercon, 2002; Pradhan & Mukherjee, 2018; Quisumbing et al., 2012). For example, Quisumbing et al. (2012) studied the impact of shocks on both single households and multiple households in Bangladesh and Uganda. Pradhan and Mukherjee (2018) studied the different coping strategies of rural poor and non-poor households during shocks in single households and multiple households in India (Pradhan & Mukherjee, 2018), whereas Debebe (2013)

studied the coping strategies of household members during different shocks in Ethiopia (Debebe et al., 2013). Temesegen et al. (2022) investigated household vulnerable factors in Ethiopia concerning shocks on single or multiple households (Temesgen et al., 2022). All of these studies have considered the impact of shocks on one household or multiple households, which is very simplistic. This categorisation also lacks the interactions between shocks affecting one household and multiple households.

It was observed that many scholars did not categorise shocks per se. Instead, they were interested in exploring the impact, coping strategies and factors affecting coping strategies during shocks in general. Only the findings of their studies have led them to characterise or categorise shocks based on different dimensions.

Some scholars explored the type of shocks, while others incorporated both the type and scale of shocks in their differentiation. Shocks identified based on the type include human health shocks (e.g. epidemics), natural shocks (e.g. natural-hazard induced disasters), economic shocks (e.g. rapid changes in exchange rates), and conflict and crop/livestock health shocks (Twigg, 2001). However, many do not provide definitions for different types of shocks. Twigg (2001) provides this types-based shock categorisation in his summary of the sustainable livelihood framework and vulnerability to disasters. This categorisation includes the characteristics of the impact of shocks. A longitudinal study conducted by Dercon et al.(2005) in Ethiopia categorised shocks into climatic (e.g. drought and flooding, erosion, frosts and pestilence affecting crops or livestock, economic (e.g. problems related to access to inputs, decrease in output prices), political/social/legal (e.g. arbitrary taxation by government authorities, social or political discrimination or exclusion and contract disputes), crime (e.g. theft and/or destruction of crops, livestock, housing, tools or household durables, crimes against persons), health (e.g. death and illness) and miscellaneous (disputes among family members and neighbours) shocks. The categorisation of Dercon and others also does not provide definitions for these different types of shocks. They further identified the scale of impact lies along a continuum as, it only affected one

household, affected some households in this village, affected all households in this village, affected the entire village and nearby villages and affected areas beyond *kebele*[5] (Dercon et al., 2005).

A similar type of categorisation could be observed in the studies conducted in other countries. For example, Haq (2015) conducted a study to identify the incidence of different types of shocks on household members in Pakistan and their coping strategies. Based on the literature review, Haq (2015) categorised shocks into six categories as: natural/agricultural shocks (e.g. earthquake, flooding, erosion, crops, or livestock diseases), economic shocks (e.g. business closures, mass layoffs, job loss, wage cuts, loss of remittances), political/social/legal shocks (e.g. court cases and bribery, long duration general strikes, violence, crime, and political unrest), crime shock and health shocks (e.g. death, injury and illness). Haq also has not provided definitions for these different shock types. In the same study, based on the household survey data in Pakistan for 2006-2010, self-reported shocks from household members were categorised into four categories: natural/agricultural, economic, social (political/social/legal), and health/life-cycle shocks (Haq, 2015). Those categories were again assessed based on scale and whether the shock impacts a single household or multiple households. For example, Haq (2015) identified natural/ agricultural shocks as significant common shocks affecting many households in Pakistan. In contrast to Dercon et al. (2015), Haq (2015) did not acknowledge the scale of the impact of a shock on households can lie along a continuum. Debebe et al. (2013) studied which shock triggers coping strategies among Ethiopian households and categorised shocks into four main types: health, natural, economic and crime/conflict-related. Then, the shocks were again categorised based on scale, whether they affected only one household or multiple households in

[5] The lowest administrative unit in Ethiopia and it is a collective of several villagesDebebe, Z. Y., Mebratie, A., Sparrow, R., Abebaw, D., Dekker, M., Alemu, G., & Bedi, A. S. (2013). Coping with shocks in rural Ethiopia. *ASC Working Paper Series*(110). , Dercon, S., Hoddinott, J., & Woldehanna, T. (2005). Shocks and consumption in 15 Ethiopian villages, 1999–2004. *Journal of African Economies*, *14*(4), 559-585. https://doi.org/doi:10.1093/jae/eji022

Kebele[6] (Debebe et al., 2013). Debebe does not define these different types of shocks. A survey undertaken by Ngenoh et al. (2018) to identify the prevalence of shocks and the shock coping strategies of rural and peri-urban smallholder farmers of African Indigenous Vegetables (AIV) in Kenya theoretically and empirically categorised shocks faced by smallholder farmers as production shocks (e.g. weather-related, natural, biological) and marketing shocks (prices) (Ngenoh et al., 2018). In this study, production shocks were considered biological, natural disasters or weather-related shocks, whereas marketing shocks were considered shocks related to prices (Ngenoh et al., 2018). Although Ngenoh provides some details about different types of shocks, it is still insufficient to define them and the scale of shocks was also not recognised in Ngenoh's study.

Both Haq (2015) and Ngenoh et al. (2018) conducted their studies to identify the coping strategies of household members during different types of shocks. Hence, their typology of shocks is based on how they identify household members' coping strategies. The study by Haq (2015) is more comprehensive than Nguenoh et al.'s (2018) study. Haq's study is based on the Pakistan panel household survey data, which has more participants than Ngenoh's study. Nguenoh et al. (2018) also recognised natural/agricultural shocks in Haq's study as production and economic shocks in Haq's study as marketing shocks. In contrast to Nguenoh et al. (2018), Haq (2015) introduced two more categories of shocks: 1) social and 2) health/lifecycle shocks. However, similar to Nguenoh, Haq has not clearly defined these shock types. Adding these two categories is due to the differences in the nature of the study and research context. Haq (2015) studied general households in Pakistan using panel data over five years, while Nguenoh et al. (2018) studied vegetable farm households in Kenya as a cross-sectional study. Identifying different shock types by these scholars is due to the differences in terms of the study

[6] Kebele is the lowest administrative unit in Ethiopia and in this study Kebele refers to peasant associations Debebe, Z. Y., Mebratie, A., Sparrow, R., Abebaw, D., Dekker, M., Alemu, G., & Bedi, A. S. (2013). Coping with shocks in rural Ethiopia. *ASC Working Paper Series*(110). Weldegebriel, Z. B., & Prowse, M. (2013). Climate-change adaptation in Ethiopia: to what extent does social protection influence livelihood diversification? *Development Policy Review*, *31*, o35-o56.

context in Pakistan and Kenya (e.g. political stability, availability of health infrastructure, abundance of climate-dependent livelihoods), the study duration, and the study sample's characteristics.

Some scholars adopted a broader categorisation of shocks because of the scope of their studies. For example, Heltberg et al. (2015) investigated the shocks and responses by households to these shocks in sixteen developing countries based on household survey data from 2004-2011 (Heltberg et al., 2015). They categorised shocks into price shocks (input, output and food price shocks), disasters (drought, water scarcity, flood, crop disease, storms), employment shocks (reduced earnings and wages and loss of job), asset shocks (loss of land, house, livestock and machinery), health shocks (death, illness, accidents and disability), crime and safety shocks (common theft and violence of all kinds), and household break-up shocks (separations, incidents involving the police and other authorities)(Heltberg et al., 2015). Heltberg et al. also do not define the different shock types in their study. In contrast to other scholars, this categorisation seems to be mixed, representing the source (e.g., health shocks) and scale (e.g., household breakups) of shocks. This may accommodate the characteristics of diverse sets of shocks that took place across different countries and allow cross-country comparisons of shocks.

Some scholars, such as Hoddinott & Quisumbing (2010), have categorised shocks based on the scale of the shock and the nature of the impact of the shock. They acknowledge that some shocks affect a single household while others affect more than one household. Developing a taxonomy of shocks, Hoddinott & Quisumbing (2010) found that shocks can affect household assets, activities and outcomes. This is a valuable contribution to identifying the impact of shocks on households. Because it identified shocks that can affect many aspects of the household; for example, natural disasters such as heavy rainfall, flooding, landslides, volcanic eruptions, earthquakes, hurricanes, strong winds as well as epidemics might affect household assets, whereas disruptions in access to inputs resulting from natural disasters, social, legal and political shocks can affect the activities of the household (Hoddinott & Quisumbing, 2010). Uncertainties in access to publicly provided goods such as schools and health

facilities are examples where shocks can affect the outcomes of a household (Hoddinott & Quisumbing, 2010). However, studies have shown that shocks affect not only one asset, activity, or outcome but can also affect all of these and beyond. For example, Dercon (2005), who studied the types of shocks and their impact on Ethiopian households over five years, considered a serious shock to be an adverse event that seriously reduced household assets, income, and consumption. Nevertheless, Dercon does not categorise shocks based on the scale of the impact (e.g. serious, moderate or minor shocks).

Several scholars have incorporated the dimension of time to explain the nature of shocks. According to Chambers & Conway (1992), small, regular, predictable, and cumulative shocks would appear in different time frames in cyclic ways, either diurnal (e.g. midday and afternoon heat, mosquitoes in the evening and the night) or seasonal. The seasonality of shocks has been recognised in several empirical livelihood studies. A study conducted by Schwarz et al. (2011) found people in rural fishing communities in the Solomon Islands perceive fishing-related issues as 'recurrent' events. Therefore, these issues are 'natural' components of their daily lives and are not considered detrimental to their livelihoods, compared to, for example, climate-related changes and natural disasters (Schwarz et al., 2011). Another qualitative study conducted in Northern Ghana to identify the climate change impacts on food security and rural livelihoods identified that food insecurity has become a 'normal' phenomenon for villagers under climate change because they predominantly depend on climate and natural resources which have been heavily affected by extended climate change effects (Akudugu et al., 2012). Their usual 'hunger period', which lasted from April to June/July each year (recurring), has extended from March to August, and the respondents see it as 'usual' (Akudugu et al., 2012). A case study conducted in a rural, coastal fishing community in the Soloman Islands showed that the respondents do not consider recurrent cyclones or tropical storms a shock compared to the earthquake and tsunami they experienced in 2007 (Schwarz et al., 2011). As some other studies showed, this area is occasionally subjected to extreme cyclones; therefore, people are familiar with such disasters. These empirical studies show the importance of 'predictability' in identifying the events as shocks. This predictability involves what type of shock will occur or when it happens. On one hand,

households might not predict the occurrence of specific shocks. On the other hand, households might not predict the time of occurrence of shocks. Therefore, this evidence suggests that how people experience shocks will depend on whether they are familiar with them and when they happen.

Some studies indicate spatial differences between shocks. According to a study by Heltberg et al. (2015), rural households in developing countries seem to be experiencing more shocks than urban households. Concerning the nature of shocks, disasters and assets/crop losses seem to be significant shocks experienced by many rural households in some developing countries compared to their urban counterparts (Heltberg et al., 2015). Therefore, Heltberg concludes that in a developing country context, rural households are more susceptible to shocks compared to urban households. This empirical evidence also shows that households experience different kinds of shocks related to health, employment, market prices, and many more (Heltberg et al., 2015). However, this study does not elaborate on the reasons for rural-urban differences in the impact of shocks.

Studies on shocks have taken different stances on a number of shocks covered in their studies. Many empirical studies investigating household vulnerability to shocks have studied the impact of a single selected shock and have ignored the shocks that might have been present simultaneously. Some studies have purposefully studied situations where households have experienced multiple shocks. Still, in other studies, the scholars sought to investigate one specific shock but found that the households they researched were also exposed to further shocks. For example, Nguyen et al. (2020) studied multiple shocks (e.g. floods, pest problems, livestock disease) and the coping strategies of households in Cambodia, while Mazumdar et al. (2014) studied the coping strategies of households during a health shock and tropical cyclone Aila which occurred in 2009 in India. However, studies investigating a single shock on households as a discrete event are more common than studies which have explored multiple shocks (Mazumdar et al., 2014). Nevertheless, there is a lack of evidence of studies describing the nature of multiple shocks.

The COVID-19 situation seems to be fertile ground for some scholars to explore the impact of multiple shocks on households. Some scholars have purposefully explored the impact of multiple shocks during this period, while others have reported the impact of other shocks when the study was initially set up to investigate only the impacts of COVID-19. A case study was conducted in a rural fishing community in the Philippines to assess the impact of a double disaster on rural livelihoods (Preña & Labayo, 2022). According to the author's classification of the type of shocks, this double disaster consisted of a natural shock (i.e. three consecutive powerful typhoons which impacted grouper[7] farm sites in early 2020) and a health shock (i.e., the COVID-19 pandemic). The authors emphasised that the impacts of these shocks exacerbated the existing shocks (i.e. lack of skills and knowledge on health management and production strategy of grouper culture among farmers) (Preña & Labayo, 2022). Farmers who don't have an adequate understanding of fish kills could not achieve high production, and it was further compromised due to the cascade of impact they faced after the pandemic (Preña & Labayo, 2022). These findings illustrate the cumulative nature of the impacts of some shocks. The occurrence of multiple shocks can result in devasting impacts on households (Mazumdar et al., 2014). Mazumdar et al. (2014) showed that household members who experienced multiple shocks faced significant difficulties in affording health expenses compared to those who experienced only health shocks.

COVID-19 caused an economic slowdown in some countries, especially in commodity-dependent developing countries in sub-Saharan Africa and Asia (Tröster, 2020). The economic slowdown and the health crisis created 'multiple crises' mutually reinforcing each other and making it difficult for those countries to respond to the pandemic (Tröster & Küblböck, 2020). Comoros[8], an island nation in south-eastern Africa, was affected by a tropical cyclone in April 2019, which coincided with the COVID-19

[7] Groupers are type of fish that commonly lives in tropical and warm waters Harikrishnan, R., Balasundaram, C., & Heo, M.-S. (2011). Fish health aspects in grouper aquaculture. *Aquaculture*, *320*(1), 1-21. https://doi.org/https://doi.org/10.1016/j.aquaculture.2011.07.022

[8] Comoros is an independent country made up of three islands in Southeastern Africa, located in the Indian Ocean Wikipedia contributors. (2023). *Comoros*. Wikipedia, The Free Encyclopedia. Retrieved 05/06/2023 from https://en.wikipedia.org/w/index.php?title=Comoros&oldid=1158353350

pandemic (European Commission Joint Research Centre,2019). The tourism sector, an essential element of its economy, collapsed due to simultaneous COVID-19 lockdown measures in Comoros (Nsababera et al., 2023), as happened in some Pacific countries (Race et al., 2023). Exploring climate change impacts and adaptation strategies of marginal communities in the Himalayan, Pacific Islands and rural Australia, Race et al. (2023) argued that multiple shocks which can co-occur or in short succession might damage people's livelihoods in the long term. The authors drew on some examples from the Pacific where storm damage (tropical cyclone Pam in 2015 and Winston in 2016), a volcanic eruption in the Tongan archipelago in 2022, and economic disruption (e.g. the collapse of the tourism sector due to COVID-19 restrictions in 2020) occurred at the same time (Race et al., 2023). This contributes to understanding the impact of simultaneous shocks or shocks that occurred at different times. Crop harvests in some countries in Asia and Africa were affected by locust swarm attacks during the COVID-19 pandemic, which pressured food supply (Xu et al., 2021). In Bangladesh, an already existing fishing ban to avoid overexploitation of marine fisheries stock was extended from 65 days to 130 days due to the COVID-19-related lockdown, and it resulted in a loss of income for fishermen and a loss of opportunity to meet household needs (Bhowmik et al., 2021; Rahman et al., 2017). These studies show that households can experience different types of shocks simultaneously.

The above review reveals some gaps in the available literature on shocks. For example, the dichotomous thinking about shocks in terms of shocks and stresses in Scoones' (1998) definition overlooks shocks' diverse, dynamic nature. Scoones (1998) definition does not accommodate large, regular, unpredictable shocks or small, unpredictable shocks with some cumulative impacts. In this doctoral research study, farm households experienced multiple shocks during the pandemic, and the shocks varied over time. Various dimensions of shocks, the relationship between shocks over time and the impact of this mix are explored in this research. Therefore, shocks are viewed as occurring on a continuum rather than simple discrete events.

This literature highlights some scholars do not purposefully classify shocks per se. Instead, they were driven by their research interests. Scholars working on households and livelihoods who are interested in coping strategies have classified shocks in different ways. There is a diversity of classifying shocks in literature. That literature primarily focuses on exploring the impact, coping strategies and other factors that enable people to cope or not in varying degrees. Some scholars used a single dimension while others used multiple dimensions to categorise shocks, presumably linked to different coping strategies.

Many scholars used characteristics of shocks and impacts to categorise shocks, whereas there was little evidence on categorising shocks based only on the impact. This review also identified that even though some scholars broadly categorised shocks into different categories, they do not adequately define what type of categories they are (i.e. shock categorisation based on the types). This literature also shows that the context where people live and operate and people's familiarity with the shocks hugely shape the nature of the impact of various shocks on households and the broader community. This review also showed that predictability of the occurrence and time of occurrence of a shock influences household experience with shocks. This has important implications for developing coping strategies, and this research also extends the existing literature by exploring coping strategies.

2.3 Household coping strategies during shocks

'Coping' has become a widely discussed research topic in different disciplines. According to Ellis (2000), who is a livelihood researcher, coping implies an involuntary response to an unanticipated shock. Ellis definition acknowledges the dimension of 'predictability' in shocks in identifying coping. Davies (1993), in the context of food security, has defined "coping" as a 'short-term response for an immediate and in-habitual decline in access to food' (Davies, 1993, pp 60). In empirical studies related to economics, coping has been identified as any actions a household takes to accommodate the effect of a shock (Debebe et al., 2013; Yilma et al., 2014). All these definitions imply that household members perform coping after a shock. According to Ellis and Davies' definition, coping is a 'response' that involves

conscious prior planning. The term 'response' differs from the immediate natural 'reaction' people usually exhibit in unexpected shocks. Therefore, these responses should be planned even before a shock takes place. In contrast, Debebe et al. and Yilma et al. consider coping as 'any actions' done by household members after a shock. This suggests 'any actions' might include responses and also reactions.

According to Adams et al. (1998), coping aims to maintain different household objectives (e.g., livelihood security, health and well-being). A common feature across these definitions shows that coping involves a response of households to the impact of shock and aims to protect the households from losing their ability to sustain household functions. It also suggests coping is triggered by the priorities in the household (e.g. household well-being and food security).

Coping strategies are methods households use when confronted with livelihood failure in their livelihoods (Ellis, 2000a). Nelson (2007), in the context of socio-ecological systems, defined coping strategies as reactive, short-term adjustments households make during challenges. Scholars like Manlosa (2019) have used Nelson's (2007) definition to study the coping strategies of smallholder farmers in southwestern Ethiopia during shocks related to a lack of capital assets and food storage.

Not all households may develop coping strategies during shocks. A study by Debebe (2013) showed households impacted by shocks cannot develop coping strategies all the time. When more than one household is being impacted, coping strategies might be limited, and households may 'do nothing' or not develop strategies as the impact is such that a response is not required (Debebe et al., 2013). The literature recognises that shocks impact households to varying extents, triggering coping strategies at various levels. Davies (1993) links this to the household characteristics, the sensitivity or otherwise of their livelihoods. According to Davies (1993), sensitivity refers to the intensity with which the shock is experienced, and highly sensitive livelihoods do not have coping strategies during shocks.

Some scholars listed examples of strategies households adopt during shocks, while others categorised coping strategies into different categories. A common categorisation of household coping strategies

distinguishes those used before a shock (*ex-ante*) and those put in place after a shock occurs (*ex-post*)(Adams et al., 1998; Alwang et al., 2001; Cooper et al., 2008; Paumgarten et al., 2020a). Different scholars in varied disciplines use different terms to categorise coping strategies. Strategies implemented before a shock are identified as *ex-ante* risk management strategies (Cooper et al., 2008), precautionary/insurance strategies (Corbett, 1988), income smoothing strategies or hazard mitigation strategies. Strategies implemented after a shock are identified as *ex-post*-risk coping strategies (Cooper et al., 2008), crisis strategies, or consumption smoothing strategies (Alwang et al., 2001; Dercon, 2002). Some scholars sub-divide *ex-post* strategies into behaviour-based (e.g. consuming less, taking children out of school for work), asset-based (e.g. use of savings, sale of agricultural land), assistance-based (e.g. assistance from relatives and friends) and borrowing-based (e.g. informal credits from friends, formal credits from banks) strategies (Haq, 2015; Heltberg & Lund, 2009).

Some scholars distinguish household strategies in terms of the impact of strategy on the household. They are identified as costly versus non-costly coping strategies (Mulungu & Kilimani, 2023). This is related to the impact that is put in place by strategies on households. According to Mulungu & Kilimani, costly strategies contribute to household asset depletion, whereas non-costly strategies do not lead to asset depletion. Similarly, coping strategies adopted during certain shocks might be more costly than strategies during other shocks. Others identify coping strategies as reversible and erosive mechanisms (Berchoux et al., 2019). This literature argues certain strategies require drawing on household resources. It is associated with the extent to which coping strategies need to use resources and assets that can be easily replaced. For example, according to Berchoux et al. (2019), a temporary activity shift during a shock is reversible, whereas the disposal of productive assets is an erosive mechanism.

This categorisation is helpful to identify the impact of shocks and changes in coping strategies over time. However, categorising coping strategies alone would not be beneficial as it does not reflect the diverse circumstances at the household level with different household resources. Developing coping

strategies is highly dependent on factors such as household capital, level of resilience, and nature of shocks.

Further, external versus internal coping strategies are distinguished (Debebe et al., 2013; Kyire et al., 2023; Paumgarten et al., 2020a). Some categorise coping strategies as on-farm versus off-farm strategies (Kyire et al., 2023). Internal strategies suggest the actions taken to draw on household resources, while external strategies involve people and resources beyond the household (Yilma et al., 2014). On-farm and off-farm strategies are self-explanatory. The simple internal-external and on-farm off-farm coping strategy categories set up a boundary around the household, and it does not recognise the influences from external processes and structures, as outlined in sustainable livelihood thinking, in shaping coping strategies. Similarly, this narrow categorisation does not acknowledge the interactions between household capitals to elicit coping strategies; therefore, it lacks a holistic approach to capturing different household coping strategies.

How coping strategies are categorised appears to depend on the research interest. Some scholars who took a holistic approach acknowledge the interactions between shock, impact and coping strategies (e.g. Yilma et al.,2014), while some do not. The interest of this study is in the multiple shocks and impacts smallholder vegetable farm households experienced during the pandemic and their coping strategies. This study will holistically view the interactions between the household, the shock, impact and coping strategies. Similarly, Yilma et al. (2014) studied which shock triggered which coping strategy and why in an Ethiopian context and found that coping strategies adopted by the affected households were primarily attributed to the nature of shock, impact and household characteristics (Yilma et al., 2014).

There is little value in categorising coping strategies for this study. The research interest in this study is to understand the context of farm households based on their level of resilience, which captures the ability to employ coping strategies and the nature of their impact on them. Different people use varied coping strategies to cope at different times. Some scholars argue that the capital base farm households

have a significant role in stabilising farmer livelihoods during shocks. For example, Berchoux et al. (2019) argue access to human and financial capital makes the livelihoods of farmers in India more stable (Berchoux et al., 2019). The impact to which a response is made also depends on whether a household is vulnerable or not. It could be assumed that highly vulnerable households tend to develop less *ex-ante* strategies than less vulnerable households. In contrast, highly resilient households tend to have more *ex-ante* strategies than less resilient households.

Adams (1998) argues that failure to cope will lead households into calamity (Adams et al. 1998) or vulnerability, as explained by other scholars. According to Adams (1998), when the impact of a shock is increased, coping strategies vary depending on the household objectives (Table 2.2).

Table 2-2: Sequence and intensity of coping strategies as shock increases

Objectives/resources	Normal times → Crisis → Calamity		
Consumption	Accumulate cereal stocks	Draw on cereal stocks	Borrow against future production
Food	Build fat stores	Moderate rationing (Reduce portions or skipped meals)	Severe rationing (consume famine foods)
		Reduce mouths to feed through migration or fostering	Depend on food aid
Health	Invest in preventive and curative care	Ignore minor health problems	Ignore major health problems
Status, loans, gifts	Invest in gift-giving, labour exchange and marriage	Claim loans and gifts from social networks or delay marriage	No loans available from social networks
	Invest in relations with merchants	Take low-interest loans from patrons/moneylenders	Take high-interest loans from money lenders

	Invest in community cereal bank	Claim from community cereal bank	Depend on begging and relief
	Accumulate status goods, i.e. jewellery	Sell surplus luxury or status goods	Sell heirloom or status goods
Livelihood assets, income	Accumulate assets and savings	Mortgage assets and liquidate savings	Sell productive assets
	Diversify productive activities	Allocate surplus labour to migration or labour sale	Allocate scarce labour to migration /labour sale
	Diversify and increase livestock holdings and/or crop cultivation	Sell surplus or small livestock	Sell large productive livestock

(Adams, 1998, p. 269)

Adams's (1998) explanations of coping strategies have been criticised by some scholars, including Ellis (2000), who argue households adopt diversification not only at regular times, as explained by Adams and some other scholars (Cooper et al., 2008), but also after a shock.

Lots of scholars provide examples of *ex-ante* and *ex-post* strategies. However, coping strategies adopted by households during shocks are illustrated in the literature reviewed to be highly contextual and, within contexts, varied across households. Coping strategies are also linked to household circumstances and the nature of shocks. The use of coping strategies by a household also depends on factors related to the shock (e.g. scale, frequency severity, type and duration)(Corbett, 1988; Debebe et al., 2013; Hoddinott et al., 2009) and its impact (Dercon, 2002) and household characteristics (Hoddinott et al., 2009; Scoones, 1998a; Tran, 2015).

Some examples of commonly identified coping strategies will be discussed in the following section.

2.3.1 Diversification

Many scholars identify diversification of activities, income and opportunities as a strategy to help people cope with shocks (Ellis, 2000b; Scoones, 1998b). For example, according to a study by Eriksen & Silva (2009), farm households in Mozambique diversified their market transactions by selling alcoholic brew, charcoal, livestock, reed mats and wild fruits to cope during drought.

The sustainable livelihood framework (SLF) (Figure 2.1) identified diversification as a long-term livelihood strategy (DFID, 1999). Some viewed diversification as an *ex-ante* strategy to help households buffer the shock's impact (Dercon, 2002; Hänke & Barkmann, 2017), while others viewed it as an *ex-post* strategy to respond to shocks. For example, Kyire et al. (2023) identified crop diversification as a strategy practised on-farm in Ghana before a shock (Kyire et al., 2023). In their study in India, Birthal & Hazrana (2019) identified risk-averse farmers diversified to non-farm activities to sustain their income (Birthal & Hazrana, 2019).

The interlinked nature of livelihood activities can be seen as a form of diversification. However, diversification may not add to household resilience during shocks. If diversified activities are interlinked and operated together during shocks, using diversification as a strategy would not be successful (Dercon, 2002; Fafchamps et al., 1998). Similarly, diversification may not be an effective strategy if a shock affecting one activity also has implications on another. This is evident in a study conducted by Fafchamps et al. (1998), who found droughts in West African semi-arid regions affect crop income and non-farm income derived from labour and business from migratory and local non-farm activities. Therefore, they argued that non-farm income could not offset crop income losses due to rainfall shocks (Fafchamps et al., 1998).

Diversification cannot be a universal coping strategy for all, as it depends on household resources and opportunities households might have. Circumstances of smallholders, including existing assets, may influence the nature of diversification, which they can use if they use diversification as a coping strategy. For example, access to assets can act as an entry constraint to diversification as a coping

strategy. In the studies done in Ethiopia and Tanzania on income portfolios of households, Dercon & Krishnan (1996) found not all households practised the same types of diversified activities. For example, only households with access to capital are involved in cattle rearing or shopkeeping. The others, typically poor, enter into activities with low entry constraints, such as collecting firewood and working as agricultural wage labourers during shocks (Dercon & Krishnan, 1996). Sometimes, diversifying activities would not give promising results due to other limitations. In the context of Mozambique, Erikson & Silva (2009) found that farm households diversified their market-related activities by selling different products such as alcoholic brew, charcoal, livestock, poultry, reed mats, and wild fruits to cope with drought. However, some farmers who used to sell charcoal to intermediaries as a coping strategy had to sell them at very low prices as intermediaries did not come to their village very often. In contrast, some farmers could transport them to different markets with more buyers and received good prices (Eriksen & Silva, 2009).

2.3.2 Consumption reduction

Consumption reduction as a coping strategy may not be visible immediately after a shock. Many scholars identified consumption reduction as an *ex-post* strategy (Hänke & Barkmann, 2017; Paumgarten et al., 2020a). In the context of Pakistan, Alderman (1996) found that if household members faced two or more consecutive negative shocks, their consumption was reduced. Dercon et al. (2005) found that the price drop in grains in Ethiopia in 2001 affected household consumption levels a few years later in 2004, resulting in a decline in household consumption by 28%. The effects would not only fluctuate households' welfare status in the short term but will have negative long-term effects on consumption and poverty (Dercon et al., 2005). A study by Yilma et al. (2014) showed that specific shocks related to natural and economic events triggered consumption reduction more than health-related shocks.

Some scholars viewed consumption reduction as a costly coping strategy requiring households to draw on household resources. For example, in the study on how types of shocks affect the choice of coping strategies by households in Malawi, Mulungu and Kilimani (2023) identified reduction of consumption as a costly coping strategy (Mulungu & Kilimani, 2023). It is argued that poor households tend to cut their consumption of essentials while wealthier households tend to cut their consumption of only luxuries. A reduction in consumption would be associated with a reduction in expenses on food, clothes, health, and transport (Adams et al., 1998).

According to Yilma et al. (2014), caution is needed when concluding households were able to protect their consumption against a shock, because household members might secure consumption from borrowings or selling assets, which would affect their future consumption. Scholars argue that reducing consumption (e.g. food) will have a long-term impact on younger household members in particular (Muthuuri et al., 2020), which would be a loss to the household. In contrast to Alderman (1996) and Decron (2005), in his review study, Corbett (1988) argues that in the context of famine in the African and South Asian contexts, households first tend to reduce consumption and then sell household assets. This illustrates the significance of the nature of shock for coping strategies. Shocks like famine would develop over time; therefore, households may need to shift to new coping strategies as the initial coping responses might not offset the impact within a prolonged period. Corbett's study also illustrates that when household circumstances worsen, they change the type of coping strategy. used.

A panel data survey study conducted by Heltberg & Lund (2009) and Haq (2015) to identify shocks, impacts and coping strategies of poor households in Pakistan identified consumption reduction as a behaviour-based *ex-post* strategy. Studies in South Africa showed that consumption reduction was uncommon among households with high physical, natural and social capital (Paumgarten et al., 2020a).

2.3.3 Labour-based strategies

Changing labour allocation in on-farm and off-farm activities (e.g. construction work, charcoal production, handicraft) is identified as a strategy to respond to shocks (Hänke & Barkmann, 2017). According to Paumgarten et al. (2020), labour-based strategies include migration in search of work and casual and community-based work in exchange for money or goods. Scholars argue that supply and demand for off-farm labour are determined by the nature of the shocks, impacts, and labour market dynamics (Dimowa et al., 2010). Using household survey data in Malawi, Dimowa et al. (2010) found that off-farm labour (*ganyu*) acts as an *ex-post* and *ex-ante* coping mechanism among agricultural households during shocks. Household data in Malawi in 2004 shows about half of rural households offer *ganyu*; therefore, engaging in off-farm labour may act as a natural insurance mechanism for households in Malawi during shocks, especially during famines (Bryceson, 2006; Whiteside, 2000). However, providing off-farm labour might not be viable for agricultural households lacking labour opportunities. Dimowa et al. (2010) and Paumagarten et al. (2020) showed that if the households are already in the labour market, it would be helpful for them to enter the labour market and continue when needed.

Culture has an implication in using off-farm labour as a coping strategy. Empirical evidence showed that households in Malawi used *ganyu* to build long-term social relationships that they could depend on in times of need (Dimowa et al., 2010). *Ganyu* has become a part of the culture in Malawi, which binds communities together, and people think of it as a social obligation to provide *ganyu* employment for needy relatives and neighbours (Whiteside, 2000). Therefore, off-farm labour might give direct and immediate insurance during shocks and indirect and long-term asset-building opportunities regarding social capital. Off-farm labour can also act as an *ex-ante* strategy to buffer the impact of shocks on households.

Many scholars found rural farm household members migrate to urban areas for employment in *ex-post* conditions and send remittances (Gröger & Zylberberg, 2016).

2.3.4 Liquidating assets

Disposal of assets seems to be a commonly reported coping strategy in shocks such as food scarcity or famines (Corbett, 1988; Hänke & Barkmann, 2017) or a mix of shocks (Lekprichakul, 2009). According to Corbett (1988), household assets fall into two broad categories: easily liquidable assets acquired in non-shock years and act as a form of saving on responding in a shock (e.g. small holders purchase sheep or goat or jewellery) and less liquidable assets (e.g. land, cattle) which help households to earn an income. Households may build up their asset base in good years to be used in bad years (Dercon, 2002; Hänke & Barkmann, 2017). Households try to reduce the cost associated with selling assets. For example, it is suggested that during famines, households first tend to use easily liquidable savings to cope with the other strategies because using easily liquidable assets does not affect productive assets, which are normally used to earn household income (Corbett, 1988). Studies conducted in developing countries showed that livestock (e.g. cattle, chicken, goats, sheep) was the main asset sold by farm households during shocks (Eriksen & Silva, 2009; Hänke & Barkmann, 2017; Paumgarten et al., 2020a).

Liquidating assets depends on market experience, accumulated assets, greater need and limited alternatives (Paumgarten et al., 2020a). Selling assets, however, may not be a viable option for households when a shock affects more than single households, as asset supply outweighs the demand; therefore, it would reduce the income households would gain through asset selling (Paumgarten et al., 2020a).

2.3.5 Use of savings

Multiple studies in various countries show that drawing from savings is a common coping strategy during shocks (Paumgarten et al., 2020a; Yilma et al., 2014). These savings might be food stocks (Yilma et al., 2014) or any other form of savings. In the South African context, this strategy was found to be common among households who had the time (i.e. older households) and income (i.e. through formal

employment or livestock sales) to accumulate savings (Paumgarten et al., 2020a). According to Yilma et al. (2014), Ethiopian households heavily rely on savings to cope with shocks related to natural and economic events. The use of savings appears to be more effective than borrowing from others when a shock affects many households.

2.3.6 Reliance on family and community-support networks

The use of family and community-support networks as a strategy to respond to a shock has been identified in different forms by scholars. This includes financial or non-financial support households might receive in shocks. Borrowings from family members (Eriksen & Silva, 2009; Hänke & Barkmann, 2017), relatives and neighbours (Eriksen & Silva, 2009; Yilma et al., 2014), friends (Eriksen & Silva, 2009), money lenders (Paumgarten et al., 2020a), and from shop owners (Hänke & Barkmann, 2017), and receiving gifts (Okamoto 2011) are evident as some forms of this support.

Some viewed relying on social networks as an *ex-ante* strategy, while others viewed it as an *ex-post* strategy. Paumgarten et al. (2020) argue kinship is an *ex-post* strategy for shock-affected households in South Africa, but the nature of households' existing social capital influences it. Hoddinot et al. (2009) show that Ethiopian households rely on support from informal social networks (e.g. neighbours and villagers) during shocks. Paumgarten et al. (2020) also found that in the South African context, households seek support from family and community-support networks (e.g. religious groups and informal savings clubs) during shocks. Studies from developing county contexts show that the use of social networks during shocks depends on household size, wealth status, social status, and gender of the household head (Hoddinott et al., 2009; Tran, 2015) without much emphasis on the nature of the social networks households might have.

Some scholars have identified how culture plays a role in using support from relatives and others during shocks. Debebe et al. (2013) and Yilma et al. (2014) found that Ethiopian households are

reluctant to receive gifts from friends and family members, believing it will destroy their self-pride. Thus, the availability of social networks alone may not help households cope with shocks. Still, it may also shaped by household members' ability, attitudes, and willingness to use their networks in a time of shock.

2.3.7 Formal borrowing

Borrowing from formal sources by households was also evident as a coping strategy during shocks. Paumagarten et al. (2020) found that receiving loans was an *ex-post* strategy adopted by households who had remitting migrants, as these remitting migrants were more aware of loan opportunities. However, the ability to obtain a loan from the formal sector can depend on household resources and household members' ability to repay the loans (Paumgarten et al., 2020a). Literature suggests some constraints that limit smallholders' access to formal loans, especially in developing countries. For example, studies indicate that it is challenging or impossible for smallholder farm households to obtain formal credit if they cannot provide collateral (Balana & Oyeyemi, 2022; Chandio et al., 2020; Hussain & Thapa, 2012). Resource-poor households may use pawning to obtain a loan from formal financial institutions, where very often they may use jewellery as collateral (Thomas et al., 2010; Tilakaratna & Hulme, 2015).

2.3.8 Support from organisations

Receiving support from organisations was another household coping strategy identified by some scholars. Relying on food aid through food-for-work programmes of non-government organisations was evident in studies done in farm households in Madagascar (Hänke & Barkmann, 2017). This strategy might be associated with the 'calamity' described by Adams (Adams et al., 1998). Support from organisations seems to be the final option a household might have, which may also be linked to

other factors. For example, when shocks last for a prolonged period, households might exhaust all their resources to implement strategies and tend to wait for external help as the final option. Similarly, even a short-term shock might devastate other possible strategies, leaving households entirely dependent on other organisations' support.

2.3.9 Migration

Household members might migrate to cope with shocks (Gröger & Zylberberg, 2016; Kubik & Maurel, 2016). Gröger & Zylberberg (2016) and Hänke & Barkmann (2017) identified rural out-migration as an effective coping strategy for agricultural households in Vietnam and Madagascar, respectively. Hoang et al. (2023) found during natural disasters in Vietnam, households who depend only on agricultural livelihoods are less likely to migrate as a coping strategy than households engaged in both farm and non-farm activities, even though natural disasters reduce their agricultural income. This empirical evidence in Vietnam shows that the attachment of agricultural households to agricultural land prevents them from migrating during shocks (Hoang et al., 2023). Migration might not be possible for households with limited household resources (e.g. money, assets and social capital) immediately after a shock (Hoang et al., 2023; Kubik & Maurel, 2016). Therefore, if resource-poor households choose to migrate to cope, it will happen in subsequent years (Hoang et al., 2023). It was also shown that in the Vietnam context, higher household size lowers the likelihood of migration during natural disasters (Hoang et al., 2023). This shows the context-specific nature of migration as a coping strategy during shocks.

Migration occurs when searching for work, taking a job or operating an enterprise (Gao & Mills, 2018; Gröger & Zylberberg, 2016). According to Gröger & Zylberberg (2016), households use remittances from migrated labour in *ex-ante* and *ex-post* conditions. Insurance networks with long-distance migrants are identified as a viable option when other local risk-sharing arrangements become ineffective during aggregate shocks (Gröger & Zylberberg, 2016). Gröger & Zylberberg (2016) showed

that higher remittances received from long-distance migrants helped Vietnamese households cope in the aftermath of Typhoon Ketsana in 2009. They also showed that households did not receive remittances from local non-labour migrants as they were also affected by the aftermath of Typhoon Ketsana (Gröger & Zylberberg, 2016). This shows that migration as a coping strategy would depend on the geographical location across which migration occurs and the scale of impact from shocks.

2.3.10 Use of locally available resources

Literature suggests some households use available resources in their local area to respond to shocks. For example, relying on non-timber forest products was identified as a common coping strategy by poor, female-headed households in South Africa during shocks (Paumgarten et al., 2020a). Depending on wild foods was also identified by scholars as a coping strategy, arguing that wild foods have a 'gap-filling' function in household food supplies during crop failures (Hänke & Barkmann, 2017; Paumgarten et al., 2020a).

Different scholars view the same type of coping strategy in various ways. For example, Eriksen & Silva (2009) view selling livestock by farm households in Mozambique as a form of diversification in market transactions, whereas many scholars consider selling livestock as liquidating household assets (Hänke & Barkmann, 2017; Paumgarten et al., 2020a). Some scholars also identified a gendered difference in adopting coping strategies (Lokshin & Yemtsov, 2004; Rahut et al., 2021). Coping strategies tend not to be used singularly; households use a mix of strategy during shocks (Lebel et al., 2021). For example, Okamoto (2011), in his study on shocks and coping strategies in a fishing community in Myanmar, found that some households sold bullocks and obtained loans to cope with household members' sickness.

Some scholars, such as Corbett (1988) and Okamoto (2011), found a coping strategy sequence. Okamoto (2011) found during the sickness or death of a household member, households tended to

use dissaving (use of cash or a combination of the use of cash and assets selling) at first, and if this was not sufficient, they tended to ask for help from others in the form of interest-free loans and gifts (Okamoto, 2011). Yilma et al. (2014) also found borrowing to be a last resort adopted by Ethiopian households during shocks. This shows coping strategies may change over time and be sequenced. Another sequence of coping strategies is introduced by Corbett (1988) in the context of famines. The strategy sequence consists of three stages: stage one as insurance mechanisms (e.g. use of intrahousehold transfers and loans, reducing consumption), stage two as disposable of productive assets (e.g. selling of livestock, selling of agricultural tools) and stage three as distress migration. Other scholars also suggest households prioritise coping strategies in response to shocks (Adams et al., 1998; Paumgarten et al., 2020a).

The literature on coping strategies suggests that households decide the composition of coping strategies (depending on their context) and the right time to implement those strategies to respond to different shocks. Reviewing strategies will reveal where the people are in the process of coping. The pandemic lasted for a prolonged period; hence, the coping strategies used by vegetable farm households in Sri Lanka are expected to be varied over time and be prioritised and sequenced. However, this prioritisation and sequencing of coping strategies might depend on household capital, which will be reviewed in the next section.

2.4 Household capitals

The SLF (Figure 2.1) acknowledges tangible and intangible household assets as the main instrument for forming livelihoods (Scoones, 1998). SLF outlines these household assets as 'capitals', which consists of five types: human capital (e.g. education, skills, knowledge and health of household members); physical capital (e.g. farm equipment, sewing machine); social capital (e.g. social networks and associations to which people belong); financial capital and its substitutes (e.g. savings, credit,

cash), and natural capital (e.g. soil, water, air, genetic resources, environmental services) (Ellis, 2000b; Scoones, 1998b). A few observations were made in the literature on household capitals.

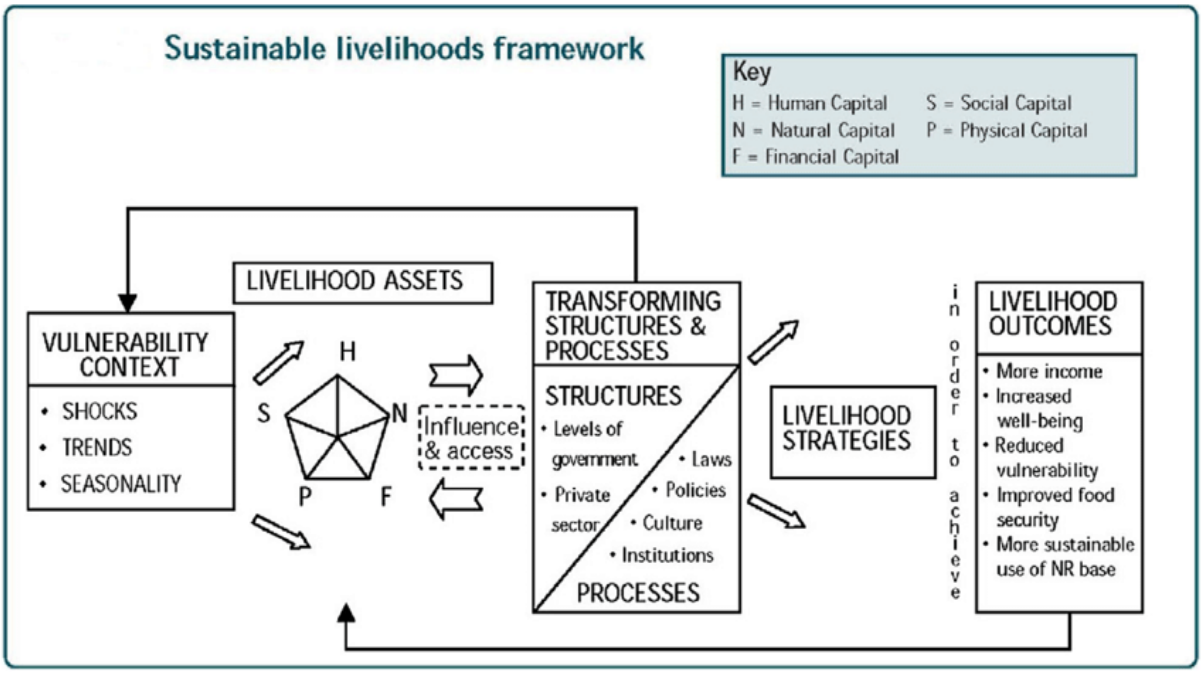

Figure 2-1. Sustainability Livelihood Framework (DFID, 1999)

First, studies showed that households use their capital to respond to shocks and that households with capital assets strive better in shocks than those without household capital (Eriksen & Silva, 2009; Thulstrup, 2015). Because household capital helps households to develop coping strategies during shocks. For example, in a study conducted in Mozambique, Eriksen & Silva (2009) found that farmers with household capital could invest in family and hire labour, dig wells and fetch water for irrigation, produce more and cope better during droughts. According to Peng et al. (2019), household capital influences the adaptive capacity, reflecting households' adaptive capacities and livelihood strategies during shocks.

Second, household capital might interact differently in eliciting a response to a shock. According to Scoones (1998), people combine capital in different ways in developing strategies, and sequencing,

substitution, clustering, access, trade-offs, and trends of household capital are important characteristics to consider when analysing household resources. The SLF does not contain a detailed discussion of these characteristics. However, the findings of several empirical studies confirm the importance of these characteristics in analysing household capital or coping strategies. For example, it has been identified that household members use a combination of different household capitals to secure their livelihoods during shocks, which is meant by capital substitution by Scoones (1998) (Eriksen & Silva, 2009; Kgathi et al., 2007). Households use different types of household capital to respond to shocks (Peng et al., 2019). According to Thapa et al. (2016), in the context of farmer-managed irrigation systems in Nepal, five types of household capitals in SLF supplement and complement each other. They show that even though many farmer-managed irrigation systems do not have adequate canal infrastructure, they perform well due to strong social capital in the form of collective action, labour contribution, and cooperation (Thapa et al., 2016). Therefore, interactions among household capitals would be helpful to understand household responses to shocks.

Third, studies suggest the level of household capital influences which coping strategy to adopt. Because different coping strategies require access to different types of capital, some scholars argue that access to capital endowment would reflect household resilience during shocks (Thulstrup, 2015).

The use of household capital during shocks might depend on other factors. For example, household interactions with structures and processes (see Figure 2.1) will also influence access to capital when responding to shocks (Thulstrup, 2015).

The following section will discuss the components and use of different household capitals during shocks. This section will also discuss how these capitals support or hinder household coping strategies in different contexts.

2.4.1 Natural Capital

Natural resources to which households have access and provide valuable means to maintain their livelihoods are considered natural capital. Some scholars considered a source of natural capital in broader terms, such as access to land, water, forest and access to environmental services (Peng et al., 2019; Thapa et al., 2016; Thulstrup, 2015), while some scholars considered detailed characteristics of natural capital. For example, Quandt et al. (2019), in their study on the role of agroforestry in building resilience among smallholder farmers in Kenya, considered not only the ownership of the farmland but also the size of the farmland and diversity of farm crops as indicators of natural capital.

Natural capital seems more significant when households have limited access to other types of capital during shocks. It was found that farm households in South Africa used non-timber forest products, such as fencing holes, to replace flood-damaged fences or used medicinal plants to treat human and livestock diseases (Paumgarten et al., 2020a). According to McSweeney (2002), in the context of Honduras, household members sell forest products during seasonal income fluctuations, and Mbiba (2019) viewed it as the 'gap-filling function' of natural resources during shocks (Mbiba et al., 2019; McSweeney, 2004). Based on Scoones (1998), this can be identified as a substitution of financial capital with natural capital. Studies have shown that asset-poor households often use natural resources to cope with shocks more than their relatively wealthier counterparts (Fisher, 2004).

2.4.2 Social capital

Social capital represents the social relationships among households from which they draw to maintain their livelihoods. According to Fisher (2013), there are no commonly accepted indicators of social capital. Instead, scholars have used several proxies to explain social capital within a given social network. Social networks (Putnam, 2000), trust (Coleman, 1988; Putnam, 1995) and norms (Coleman, 1988; Putnam, 1995) are some of the commonly identified and discussed proxies of social capital in empirical studies (Carter & Maluccio, 2003).

Many studies suggest that households use social capital as informal insurance during shocks (Carter & Maluccio, 2003; Mogues, 2006). It has shown especially that poor or vulnerable households, who usually do not have adequate access to formal insurance, savings, and human capital, rely on social capital to respond to shocks (Mogues, 2006; Peng et al., 2019). According to a case study by Misselhorn (2009), in the context of the KwaZulu-Natal community in South Africa, access to financial capital is required to benefit from social capital. This appears to be linked to the idea of 'sequencing' of capitals, as Scoones (1998) argued, which implies that access to one capital will become a precursor to accessing other capitals. Another study showed that members who could not contribute financially to *stokvels*[9] were excluded from the group (Misselhorn, 2009). This shows that access to social capital alone would not be helpful during shocks, as the use of social capital would depend on access to other household capitals.

Scholars consider bonding, bridging, and linking social capital as the primary forms of social capital. Woolcock (2001) argues that combining these three types of social capital gives the expected outcome for households (Putnam, 2000; Woolcock, 2001). Bonding refers to the strong ties among the people who are in the same community (e.g. family, ethnic or religious groups), whereas bridging relates to the links among people in distant and different communities (e.g. cooperation with other firms) (Marcello et al., 2017; Vecchio et al., 2022). Linking social capital refers to the vertical links among people across different hierarchical levels or institutional power in society (e.g. bankers, extension officers) (Szreter & Woolcock, 2004; Woolcock, 2001). Scholars found how different types of social capital become significant over others during different shocks. For example, in their study in the South African context, Carter & Maluccio (2003) argue that bonding social capital supports households to respond to shocks confined to an individual household while bridging social capital helps respond to

[9] A form of community organisation in the South Africa which provides rotating financial assistance for the members Misselhorn, A. (2009). Is a focus on social capital useful in considering food security interventions? Insights from KwaZulu-Natal. *Development Southern Africa*, *26*(2), 189-208. https://doi.org/10.1080/03768350902899454

shocks affecting more than one household. This shows households use different types of relationships and networks during shocks, which is important in developing coping strategies.

The social capital of households involves different people and institutions who are helpful in various ways when households face shocks. For example, a study done by Paumgarten et al. (2020) in South Africa found that kinship is a good option for vulnerable households with low livelihood and coping options during shocks. According to Nguyen (2011), during annual floods in the Mekon River Delta in Vietnam, households received neighbour support in different forms, such as support to evacuate during floods, support to repair houses, lending money and food, sharing information on opportunities in floods season (e.g. fishing techniques, collecting fish and snails). Abid et al. (2020), in the context of Malawi, found that farmers with improved access to markets and extension services and farmers who were members of farmer groups were better able to cope with climatic shocks than farmers who did not have such.

In summary, studies suggest households with adequate access to social capital cope better during shocks than households without adequate access to social capital (Skoufias, 2003).

2.4.3 Physical capital

The tangible assets households might have that are important to maintaining their livelihood have been considered physical capital. Different scholars have identified different types of physical capital, such as production tools or farming equipment, information media, access to irrigation schemes, and the presence of facilities near home (e.g. schools and hospitals) (Peng et al., 2019; Quandt et al., 2019; Theron et al., 2023). This shows sources of physical capital can be located within the household (e.g. farm equipment) or outside of the household (e.g. schools). The sources of physical capital located outside the household, which seems to be a community property, might act as a source of capital for several households. This also suggests that a shock on some forms of physical capital might affect more than one household. Similarly, developing such common types of physical capital might benefit multiple households.

Physical capital is linked to other types of household capital in different ways. For example, Theron (2023), in his study on agricultural resilience and adaptive capacity among apple farmers during a severe drought in the western cape of South Africa, found natural capital (i.e. rainfall) is 'complemented' by physical capital (i.e. irrigation from boreholes, dams and runoff from rivers). Many scholars have discussed the use of physical capital during shocks. For example, Peng et al. (2019) found production tools and information media help farmers during shocks.

Scholars have identified the same sources of physical capital in different ways. For example, some scholars identified land and livestock ownership as sources of physical capital (Abid et al., 2020). In contrast, other scholars consider land and livestock as natural capital (Quandt et al., 2019). Literature shows access to physical capital improves households' ability to develop coping strategies. Abid et al. (2020) identified that large-scale farmers with more land adopt coping strategies during climatic shocks more than small-scale farmers with small-sized lands. This example suggests large-scale farmers with high levels of physical capital are more resilient during shocks than small-scale farmers who do not.

Access to physical capital would help farmers to decide which coping strategy to choose. In the context of Ghana, Boansi et al. (2023) considered livestock as physical capital, and they found farmers with livestock are less likely to migrate during harvest failures. However, similar to other capitals, using physical capital might also depend on different factors. For example, even if a farmer has access to a large land, there might be a lack of utility from the land if other types of capital, such as irrigation (i.e. natural capital) or finances (i.e. financial capital) to purchase farm inputs such as seeds and agrochemicals are not available.

2.4.4 Human capital

Socio-demographic factors such as age, education, health, knowledge, skills, experience, household size, and labour availability are considered by scholars as human capital indicators (Abid et al., 2020; Cao et al., 2016; Peng et al., 2019). A study done by Peng (2019) on farming communities in

mountainous regions in China showed that compared to social or physical capital, human capital, such as education, health, and skill, supported farmers in better coping with shocks.

Different forms of human capital influence coping strategies in various ways. In the Ethiopian context, literate households tend to reduce consumption as a coping strategy during climate change than their illiterate counterparts (Alemayehu & Bewket, 2017). This means human capital supports households to become resilient during shocks. In the context of Malawi, Abid et al. (2020) found educated farmers are more likely to adopt climatic shocks than their less educated counterparts. Meanwhile, in the rural Australian context, Caldwell & Boyd (2009) found that younger farmers could cope with drought as they could change their careers than their older counterparts. Muthelo et al. (2019) identified that female and young smallholder farmers in South Africa are less likely to adopt water-use restrictions as a coping strategy during droughts than male and old counterparts.

Studies suggest the reciprocal links between human capital and coping strategies. Using human capital support to develop coping strategies while adopting specific household coping strategies during shocks might lead to undesirable consequences on household human capital. For example, dropping kids from school (Helgeson et al., 2013; Skoufias, 2003) during shocks would affect household human capital in future.

Studies also confirm that access to human capital alone would not help develop successful strategies during shocks without adequate access to some other household capital.

2.4.5 Financial capital

Savings, annual cash income, loans, access to credits, salaries, access to bank accounts, and remittances are identified by scholars as indicators of financial capital in households (Abid et al., 2020; Peng et al., 2019; Quandt et al., 2019). Some scholars view livestock and ownership of farm equipment as forms of financial capital that help households use as a source of finance during shocks (Quandt et al., 2019). Meanwhile, it is evident that if a shock affects more than one household and many

households sell assets at once, it might reduce the usefulness of livestock as a source of financial capital (Paumgarten et al., 2020a). This shows the scale of shock impact affects the use of different forms of capital during shocks.

Access to financial capital is sometimes strongly linked to household strategies developed before or after a shock. For example, a study by Abid (2020) in Malawi showed that farmers could not adopt any measures before climatic shocks because of a lack of financial capital. A study done by Boansi et al.(2023) in Ghana showed farmers with better access to credits are less likely to migrate (as a coping strategy) during harvest failure (Boansi et al., 2023). In the context of Malawi, it showed that farmers who got access to credits were more interested in developing coping strategies during climatic shocks than the farmers who did not have access to credits. Farmers used such credits to buy drought-tolerant varieties, fertilisers, and other crop inputs (Abid et al., 2020). These inputs might act as natural, physical or human capital for those farmers. This shows that access to adequate financial capital at the farm household would help farmers implement strategies to improve other types of capital, as argued by Theron et al. (2023).

2.5 Impacts of the COVID-19 pandemic on smallholders

The impacts of the COVID-19 pandemic on smallholders and the coping strategies of farm households in developing countries has been the focus of studies (Adhikari et al., 2021; Harris et al., 2020; Hossain, 2018; Kumar et al., 2023; Marsden et al., 2023; Paganini et al., 2020; Tripathi et al., 2021). Some have specifically investigated the impact of the pandemic on vegetable farm households (Alam & Khatun, 2021; Kumar et al., 2023; Yegbemey et al., 2021), while others have explored the impact on smallholders in general (Tripathi et al., 2021). For example, Kumar et al. (2023) studied the continued effects of COVID-19 on the lives and livelihoods of vegetable farmers in India and found that the farmers decreased vegetable production, had difficulties in accessing inputs (e.g. fertilisers, pesticides, vegetable seeds/seedlings), hiring labour, marketing their products, reduced the household food

consumption and experienced lower household income during this period. A study conducted in Bangladesh on vegetable farmers showed that due to COVID-associated travel restrictions, traders could not visit farmers' fields, and consequently farmers' income and profit was reduced (Alam & Khatun, 2021). Tripathi et al. (2021) studied the impacts on a diverse range of production systems, including vegetables, on small-scale mixed farming systems in Tanzania to large-scale corporate firms in South Africa. This study found that smallholders in Tanzania and South Africa also experienced sales and income loss due to market closure and lack of labour availability. These smallholders also had difficulties in accessing farm inputs (e.g. seeds. chemicals, essential services, livestock medicine) because of loss of income, closure of farm shops and travel restrictions at the time (Tripathi et al., 2021). These findings align with a study in Nigeria which found that vegetable smallholders faced shortages in input supplies (e.g. pesticides, fertilisers and seeds) and income loss due to a general lockdown, curfew, market closure and travel restrictions (Yegbemey et al., 2021). In addition, the high cost of medicines was a key impact faced by smallholders in Nigeria during this period (Yegbemey et al., 2021). A study by Marsden et al., (2023) showed that the most common pandemic impacts on smallholders included disruption to input supply and markets and labour shortages.

Studies on the pandemic impact have captured some of the changes that occurred in smallholder livelihoods. For example, Alam & Khatune (2021) found that some household members in Bangladesh who worked in urban areas lost their jobs due to the pandemic. These household members returned to the farm and supported farming activities by providing farm labour (Alam & Khatun, 2021). Similarly, Tripathi et al. (2021) found that people in Tanzania purposely avoided urban areas and worked on farms during this period, which eased the labour availability problems during this period. Loss of off-farm activities (e.g. selling foods to school children, selling poultry products for social events) were evident in Tanzania and South Africa while thefts of livestock, stored grain and agricultural equipment were evident in South Africa during this period (Tripathi et al., 2021).

Several studies have identified that, in addition to the COVID-19 pandemic, smallholders also faced other shocks during the pandemic period, such as extreme weather and pest and disease problems, which resulted in production and income loss for smallholders (Alam & Khatun, 2021; Tripathi et al., 2021). According to Tripathi et al. (2021), the shocks due to extreme weather and pest and disease problems are 'compounded shocks'. However, there was little explanation of the nature of these compounded shocks. According to Tripathi et al. (2021) extreme weather and pest and disease problems are successive, followed by COVID-19. For example, during this period, some farm households in South Africa had to plant late due to delays in rains. The late planting was followed by an early frost, which ultimately affected the cultivation season (Tripathi et al., 2021). Some farmers were also affected by the lack of rain and pest and disease problems, which worsened due to a lack of inputs during the pandemic (Tripathi et al., 2021). These examples show the multiple shocks farmers had to deal with during the pandemic; this doctoral research also shed light on the cumulative and interconnectedness of shocks and their impacts on smallholders.

The challenges faced by farmers during the pandemic were acknowledged by other scholars. For example, Kumar et al.(2023) identified that it was not only the pandemic, but also there were pest and disease problems, weather-related disruptions and other COVID-19 related issues such as high health expenses, loss of off-farm work and return of migrant family members, which contributed to low household income for vegetable farmers in India (Kumar et al., 2023).

A study by Tripathi et al. (2021) highlights that smallholders in Tanzania who had diversified production systems, and those who were engaged with international markets were less impacted by pandemic impacts. Although the impact of the pandemic on smallholders has been shown to differ to that of commercial farmers (e.g. in South Africa), commercial farmers experienced difficulties in accessing harvest loans (Tripathi et al., 2021). However, overall commercial farmers were shown to have better access to capital, markets and information and could transport produce to the markets even during lockdowns (Tripathi et al., 2021).

2.5.1. Coping strategies by smallholders

Smallholders develop various strategies to respond to the impacts experienced during the pandemic period. Yegbemey et al. (2021) found that smallholders in Nigeria developed seven types of strategies to cope with the COVID-19 pandemic impacts and they have been categorised into two categories; production-oriented strategies (producing fewer crops for selling, producing more of their own foods, eating more own production) and market-oriented strategies (processing more, storing more, finding new markets, reducing the selling price). This is supported by the work of other scholars in different contexts (Alam & Khatun, 2021; Kumar et al., 2023; Tripathi et al., 2021). For example, while supporting the production-oriented strategies, Tripathi et al. (2021) found reducing the scale of production as a strategy among smallholders in South Africa while Alam et al. (2021) and Kumar et al. (2023) identified eating more of their own production a strategy among smallholders in Bangladesh and India, respectively. Kumar et al. (2023) also identified reducing the selling price as a marketing-oriented strategy in the context of smallholders in Bangladesh. Several other marketing-oriented strategies, such as selling produce directly to local customers (Alam & Khatun, 2021), increased sharing of vegetables with friends and relatives (Alam & Khatun, 2021) and selling produce among smallholders themselves (Tripathi et al., 2021) were also identified by these scholars.

In addition to production-oriented and marketing-oriented strategies identified by Yegbemey at al (2021), scholars identified other types of categories which is related to food consumption and the financial situation of the household. These strategies included reducing household food consumption (Alam & Khatun, 2021), reducing the consumption of expensive food items including meat, sugar, rice and milk (Tripathi et al., 2021), reducing household expenses (Kumar et al., 2023), eating less (Kumar et al., 2023), buying cheaper foods (Kumar et al., 2023), borrowing money (Kumar et al., 2023), finding other work (Kumar et al., 2023), receiving food aid/ support (Kumar et al., 2023), drawing on family labour to reduce the labour cost (Tripathi et al., 2021) and using own transport to procure agricultural inputs and transport labourers (Tripathi et al., 2021).

Farmers' coping strategies varied based on the enterprise size, production model, level of capital access and market engagement, and farm-system diversification (Tripathi et al., 2021). For example, a study in South Africa and Tanzania showed that large-scale farmers with access to capital could purchase agricultural inputs in advance, and farmers with assets (e.g., livestock) could sell them to cope (Tripathi et al., 2021). Another study in Nigeria found that farmers' socio-economic characteristics including age, education level, marital status, household size, asset index, whether farmers produced vegetables during the last 12 months, access to credit and government or private extension services, the effects of COVID-19 and challenges in accessing inputs, in storage and selling influenced smallholders to adopt coping strategies (Yegbemey et al., 2021). For example, older farmers, married farmers, farmers with access to credit, farmers with a stronger perception of COVID-19, and farmers with more challenges in storage and sales were more likely to adopt production-oriented strategies. For example, farmers with access to credits are more likely to produce fewer crops for selling but more for consumption. Farmers with large household sizes and faced challenges accessing farm inputs were less likely to adopt production-oriented strategies. In contrast, the education of farmers, household assets and private extension services had mixed effects on farm households' decision to adopt production-oriented strategies. For example, wealthier households were more into producing more for home consumption than producing fewer crops (Yegbemey et al., 2021).

Yegbemey et al. (2021) also showed that farmers who produced vegetables in the past 12 months, farmers supported by the government extension services, and farmers who faced challenges in storage and sales were more likely to adopt marketing-oriented strategies. For example, farmers who faced challenges in storage and sales were more likely to do processing and finding new markets. Older farmers, farmers with large household sizes, and farmers who faced challenges in accessing farm inputs were less likely to adopt marketing-oriented strategies, whereas the marital status of the farmer had mixed effects on adopting marketing-oriented strategies. For example, older farmers exhibited a low capacity to make new investments and preferred to continue subsistence production rather than finding new markets (Yegbemey et al., 2021).

Some strategies were not related to crop production or marketing. For example, according to Tripathi et al. (2021), farm households used digital services and mobile phones to conduct farmer meetings online and to purchase household essentials from nearby towns during travel restrictions. The reviewed studies on the farm household coping strategies during the pandemic capture a snapshot of coping strategies; and do not expand on if or how strategies change over time e.g. (Alam & Khatun, 2021; Marsden et al., 2023; Nsababera et al., 2023; Tripathi et al., 2021; Wordofa et al., 2023; Yegbemey et al., 2021).

Smallholders started to use new strategies they thought would help them face similar kinds of situations in the future. For example, the study by Tripathi et al. (2021) shows that in the context of Tanzania, farmers learnt the importance of storing foods because of the food access problems they had to face during the pandemic and, therefore they started to store cereals to face similar kind of situation in the future.

2.5.2. Impact of the pandemic on smallholders in Sri Lanka

The impacts of the pandemic on farm households in Sri Lanka has been studied (Mahaliyanaarachchi et al., 2020; Mufeeth & Kaldeen, 2022; Roshana & Hassan, 2020; Sachitra & Padmini, 2021; Singh et al., 2021) with some specifically focusing on vegetable and fruit farmers (Gunawardhana et al., 2022; Karunarathna et al., 2024). According to the available literature, these impacts on smallholders in Sri Lanka are similar to the pandemic impacts on smallholders in other countries (Adhikari et al., 2021; Alam & Khatun, 2021; Marsden et al., 2023; Tripathi et al., 2021).

Unavailability of labour, inability to access markets due to transportation issues, inability to access sufficient sources of foods due to trade and travel restrictions, supply chain disruptions due to the disruptions in transportation and consumer demand were observed among farmers in Sri Lanka during the pandemic (Gunawardhana et al., 2022; Karunarathna et al., 2024; Roshana & Hassan, 2020). According to Gunawardhana et al. (2022), in the context of vegetable and fruit farmers in the Galle district, there was a significant difference in the number of employees, extent of land cultivation,

income and yield per season after the pandemic (i.e. in the year 2021) compared to the pre-pandemic situation (i.e. in the year 2018). Farm production was affected by rising prices of raw materials including inorganic fertilisers, pesticides, weedicides, seeds and planting materials) and reduction of hired labourers (Gunawardhana et al., 2022). According to Gunawardhana et al. (2022), the government policy on import restrictions led to a price hike in farm inputs. Policy changes that occurred during the pandemic in Sri Lanka also influenced farmers. Lack of access to agrochemicals, increased agrochemical prices, quality degradation of raw materials, difficulties in produce distribution, and reduced demand and sales were also identified by others as impacts on smallholders during this period (Rathnayaka et al., 2023).

Vegetable and fruit farmers struggled to reach customers during this period resulting in reduced income (Gunawardhana et al., 2022). Lack of demand for fruits and vegetables from customers and resultant wastage of produce, delays in deliveries, and price changes resulted in low incomes during this period (Karunarathna et al., 2024).

2.5.3. Coping strategies by smallholders in Sri Lanka

Few studies capture the coping strategies smallholders in Sri Lanka used to respond to the pandemic impacts. Gunawardhana et al. (2022) found that farmers developed strategies such as integrated farming management, getting support from family members, changing the number of planting cycles, applying for bank loans, direct marketing, diversifying the business, practicing shift work for farm workers, changing the type of vegetable/fruit cultivated, and taking measures to improve health and safety of farm workers. But the study done by Gunawardhana et al. (2022) does not elaborate on strategies used by vegetable farmers. For example, it is unclear what types of integrated farming management practices the vegetable farmers in Sri Lanka used during this period.

When farmers could not sell their produce, some used multiple marketing methods such as roadside marketing and direct marketing as evident among farmers in Badulla district (Rathnayaka et al., 2023). Rathnayake et al. (2023) found that in the context of farmers in the Badulla district, only a few farmers

adopted strategies such as temporary moving to new trades, inputs, production, processing and post-harvest management techniques and new marketing methods. In contrast, most farmers did not attempt these innovative approaches and continued their conventional production and marketing. However, it was unclear how the majority of farmers produced and marketed their produce during this period amidst the disruptions. This study by Rathnayake et al. (2023) also provides evidence that a few numbers of farmers shifted to new income-generating activities or new businesses by capitalising on the opportunities that emerged with the pandemic, but with a limited explanation of these opportunities.

2.6 Conclusion

Fundamentally, shocks result in negative consequences for households. Therefore, household members develop strategies to respond to the impacts of shocks, and these strategies may change over time. The characteristics of shocks, impacts and households, influences households' coping strategies during shocks. One of the main factors determining coping strategies are household resources, including human capital, social capital, natural capital, physical capital and financial capital. Households use different types of capitals in various ways to develop coping strategies. But how these capitals are helpful in which way is still poorly discussed in the literature.

Scholars have identified several impacts of the pandemic on smallholders, which include disruptions in production and marketing activities and other livelihood activities due to lockdown and travel restrictions. Smallholders develop various strategies to cope with the impact, but the types of these strategies are similar across smallholders in different countries, including in Sri Lanka. This review found that there was little explanation of the coping strategies and factors affecting coping strategies used by smallholders in Sri Lanka. In the next chapter, the research strategy used in this study to understand the impacts of shocks and coping strategies of farm households in Sri Lanka will be outlined.

3) RESEARCH STRATEGY

3.1 Introduction

This chapter explains the research design used for this study to understand how farm households in Sri Lanka were affected by shocks associated with the COVID-19 pandemic and how they responded. This chapter opens with the philosophical basis used in the study and followed by explaining the research paradigm, research design, research strategy, case selection, site selection, participant selection, data collection, data analysis and ethical concerns.

3.2 Research paradigm

Scholars identify the research paradigm or research philosophy as the initial step in the research process, leading to all subsequent steps in the research process (Al-Ababneh, 2020). This principally means how a researcher sees the world, and many scholars highlight the importance of identifying the relevant research paradigm at the early stages of research (Kivunja & Kuyini, 2017; Mackenzie & Knipe, 2006). According to Kivunja & Kuyini (2017), a paradigm constitutes the abstract beliefs and principles that shape how a researcher sees the world and how s/he interprets and acts within that world. According to Saunders et al. (2009), the research paradigm is associated with the researcher's belief system or worldview.

The interconnected, generic activities of the research process that have been identified, consists of theory, ontology, epistemology, methodology and analysis (Denzin & Lincoln, 2008). According to Denzin & Lincoln (2008,p. 28), '*the gendered, multiculturally situated researcher approaches the world with a set of ideas, a framework (theory, ontology) that specifies a set of questions (epistemology) that he or she then examines in specific ways (methodology, analysis)'*(Denzin & Lincoln, 2008). Selecting a relevant research paradigm helps decide what to study, how to study, and how to interpret the research results (Kivunja & Kuyini, 2017).

Different research paradigms or philosophies, such as positivism, realism, interpretivism, and pragmatism, are discussed in the literature (Saunders et al., 2009). Each research paradigm involves different world views. This study will adopt an interpretivism approach. The interpretivism approach looks for interpretations of the social world and believes that each subject being studied is unique and different from other situations (Al-Ababneh, 2020). This study was conducted with smallholder vegetable farm households in Sri Lanka, where their experiences during the pandemic are believed to be unique.

Four major interpretive paradigm structures have been discussed by Denzin & Lincon (2008): positivist and post-positivist, constructivist-interpretive, critical (Marxist, emancipatory), and feminist-post structural. This study adopted a constructivist-interpretive approach, because the researcher of this study accepts that multiple realities exist (relative ontology), and the understanding of the research area was co-created by the researcher and the respondents (subjectivist epistemology) in the natural world, as argued by scholars (Denzin & Lincoln, 2008; Ponterotto, 2005). Interpretive research helps to develop rich descriptions of the phenomena studied (Hussain et al., 2013). Constructivism acknowledges that reality is generated within individual minds (Hansen, 2004). Therefore, rich descriptions of reality are achieved through interaction between the researcher and the participant (Ponterotto, 2005). Thus, the understanding of farm households' experience during the pandemic was gained through the meanings that emerged during mutual discussions between the researcher and the farm households.

3.3 Research design

This study used an exploratory research design. The COVID-19 pandemic was a new phenomenon and minimal knowledge exists on how farm households in Sri Lanka responded to this shock. Researchers often use an exploratory approach when they have little or no scientific knowledge about the phenomena of interest but believe it contains elements worth discovering (Stebbins, 2001).

Due to the novelty of the pandemic (Shirani et al., 2020; World Health Organisation, 2019) and the lack of literature on the subject (Filimonau et al., 2022; Green et al., 2021), most of the recent studies on COVID-19 across a range of disciplines (Green et al., 2021; Oliveira et al., 2021; Rao et al., 2022; Udmale et al., 2020) have employed inductive, exploratory approaches. An exploratory approach is used to understand better the subject of interest (Filimonau et al., 2022; Green et al., 2021) and produce inductively generated generalisations about the subject matter of interest (Stebbins, 2001). According to Rahi (2017), the purpose of exploratory research is to assess phenomena in a new light, and this type of research is commonly adopted in the early stages of research (Rahi, 2017).

This study mainly focuses on the impact of the COVID-19 pandemic, and the response mechanisms of farm households in Sri Lanka. Households possess a range of levels of different types of capital, and they use different combinations of household capital to respond to uncertainty (Manlosa et al., 2019). This complexity is likely also to be the case for farm households in Sri Lanka during the COVID-19 pandemic. Therefore, this research adopted an exploratory approach. It was a qualitative study, a predominant strategy in exploratory studies (Stebbins, 2001).

3.4 Research strategy

The exploratory qualitative case study research strategy was used in this study. Qualitative research methods provide a rich description and a holistic overview of the phenomena studied, giving voice to the people who are otherwise rarely heard (Miles, 2020; Sofaer, 1999). Qualitative research is conducted through prolonged contact with participants in their natural settings to describe and explain how participants take action or manage their daily situations (Miles, 2020). According to Denzin and Lincoln (2008, p 4), '*qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them*'. Therefore, qualitative researchers use multiple methods and senses to collect, understand and interpret the meanings generated by the respondents. Denzin and Lincoln (2008, p 34) argue that qualitative research is

'*endlessly creative and 'interpretive'*. Therefore, the researcher's interpretations of the phenomena being studied become significant in qualitative research. Qualitative research also helps to understand the events and the context where the events taking place (Sofaer, 1999) and, according to Aspers & Corte (2019), qualitative research has following characteristics :

1) It makes significant new distinctions to the scholarly community.
2) It involves an iterative process that involves several phases.
3) It develops close contact with the subject/ phenomenon being studied.
4) It improves the understanding of the subject being studied as the research outcome (Aspers & Corte, 2019)

Given the novelty of the research topic, this study aimed to contribute significantly to scientific knowledge through repeated and close contact with farm households. The case study was selected as the most suitable research strategy for this study in order to understand the Sri Lankan vegetable farm households context during the pandemic. A case study is mainly being considered as a qualitative research type (Starman, 2013), which involves an intensive study of a single unit to better understand other units of that nature (Feagin et al., 2016; Gerring, 2004) as experienced in this study. It does not reflect what is to be studied (Flyvbjerg, 2011); instead, it focuses on how and why a particular research focus is being studied (Yin, 2003). This study aimed to answer how farm households responded to the impacts of shocks during the pandemic and why they responded in this manner. Selecting a case study approach was advantageous for in achieving research objectives, as it allowed me to study the social structures and social actions in their natural settings and enabled collecting information from multiple sources.

3.5 Case selection

The phenomenon of interest in this study is farm households' strategies in response to the COVID-19 pandemic. In qualitative studies, the ''case' is a phenomenon occurring in a bounded context (Miles,

2020). The boundaries of the case can be decided based on area, time, or context. A case may also be defined by a role, small group, organisation, space and environment, community or settlement, episodes and encounters, event, period, process, culture or sub-culture, or nation (Feagin et al., 2016; Miles, 2020). Therefore, the case in this study was vegetable farm households impacted by the pandemic who, before the pandemic, relied on vegetables as a source of household income. The case study approach was fit for this study as it studied the nature of the pandemic's impact on vegetable farm households in Sri Lanka in their natural setting. It also tried to capture the nature and changes in the farm households ' responses during the lengthy pandemic period.

Deciding which case study design to adopt is highly contextual (Baxter & Jack, 2008). According to Yin's (2003) classifications of case study designs, this study was conducted as a single case study and an exploratory case study. Adopting a single case study approach helped to understand the holistic nature of the pandemic's impacts, the responses of farm households, and the reasons for adopting particular responses.

3.6 Site selection

There were several criteria used to select a site for the study. The site had to: 1) be an area where the commodity chosen (vegetables) is a prominent agro-production system, 2) be an area with a high number of vegetable farm households, 3) be an area susceptible to different shocks, 4) be an area with easy access for the researcher with the ongoing COVID-19 crisis.

Central Province in Sri Lanka fulfilled the above criteria. Therefore, it was selected as the site for this study. The Central Province covers three districts, and this study was conducted across the Nuwaraeliya and Kandy districts (Figure 3.1). These districts were selected using a purposive or judgmental sampling technique, which is ideal for exploratory studies (Malhotra and Birks, 2006). The purposive or judgmental sampling technique is a sampling strategy which involves a deliberate selection of participants for a study due to their unique qualities (Etikan et al., 2016; Taherdoost, 2016).

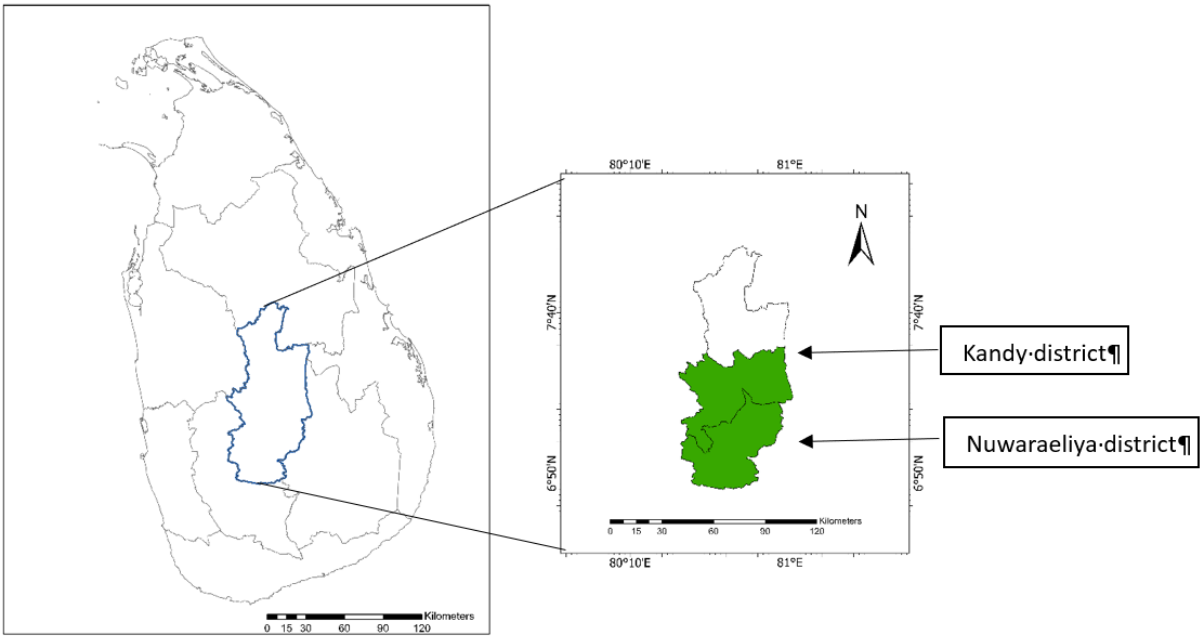

Figure 3-1.Location of the study area in the Central Province

Purposive sampling focuses on the unique context of the case (Miles, 2020). The Nuwaraeliya and Kandy districts were selected for this study to capture heterogeneity. First, there was a difference between the two districts regarding land use and the intensity of vegetable cultivation. In the Nuwaraeliya district, the land area under vegetable production was greater than that of the Kandy district. Secondly, in the Nuwaraeliya district, vegetable production was carried out year-round; in contrast, to the Kandy district, where vegetable production was seasonal. Thirdly, compared to Kandy in Nuwaraeliya, access to markets and agricultural services varied depending on urban and rural differences within the district. Urban farm households were close to main vegetable markets such as dedicated economic centre and were tended to be suppliers of vegetables to hotels, restaurants, supermarkets. They also have easy access to agricultural services related to inputs and government financial services. Rural farm households very often had to transport vegetables to markets in the distant areas and they mainly supplied vegetables to the middlemen resided in these areas. Rural farm households have restricted access to some services such as government financial services. These

differences helped explore how vegetable farm households in these case sites were exposed to different shocks and how they developed strategies during COVID-19.

3.7 Participant selection

This single case study was conducted in three phases: scoping phase, key-informant interviewing phase, and in-depth farmer interview phase, with different objectives in each phase. The scoping phase was an exploratory phase. In the scoping phase (Phase I), ten preliminary interviews were conducted with the Central Province vegetable farmers to understand the context and research focus. The main purpose of having a scoping phase was to identify the study sites and the key informants and develop data collection protocol for the key informants and farmers. Both Nuwaraeliya and Kandy districts belonged to the Central Province; therefore, as the first point of contact, the Deputy Provincial Director of Agriculture in the Central Province was contacted to obtain permission for the study and to identify the key informants for this study.

The key informant interview phase (Phase II) involved several key personnel in the area, including the Deputy Provincial Director of Agriculture in the Central Province. The key informant interview phase helped to collect specific information on the nature of vegetable production and marketing in the area, and the impact of the pandemic on farm households. The final phase (Phase III), with in-depth farmer interviews, helped to understand the farm households' context during the pandemic and their responses to the impacts. The following section explains how the Phase II and III participants were selected.

3.7.1 Selecting key- informants in phase II

Once the basic understanding of the context and an idea of who the key informants were was obtained from the scoping phase, the selection of key informants was carried out. Interviewing key- informants

is one of the main data collection methods in case study research (Sofaer, 1999). Using Tremblay's (1957) guidelines there were four main purposes utilised for selecting key informants as follows:

-To develop a working definition of the nature of pandemic impact

-To identify the boundaries of the community studied, i.e. vegetable farm households in the Central Province

-To identify the farm households who had an extreme impact from COVID 19

-To increase the knowledge of the phenomena being studied

Key informants are a very important source of expert knowledge (Marshall, 1996; McKenna & Main, 2013) and act as gatekeepers who regulate access to information and to other study participants (McKenna & Main, 2013). Twelve key informants were selected and interviewed across Nuwaraeliya and Kandy districts. Key informants were identified as people with more than five years of experience in either or both case sites, with the vegetable farmers and farming, who held various professional or community positions, and were able to offer a breadth of perspective. This included both officers and farmers.

Therefore, selecting appropriate key informants is identified as a vital step in research. The following criteria were used to determine this study's most appropriate key informants (Tremblay, 1957).

i. Having a formal role in the community
ii. Knowledgeable about the area of study, i.e. of the vegetable production system and the vegetable farm households in the area
iii. Willingness to participate in the study
iv. Able to clearly communicate with the researcher
v. Impartial with minimum personal biases

Purposive and snowball sampling methods were used to select the key informants. The first key informant interview was conducted with the Deputy Provincial Director of Agriculture in the Central

Province, and based on her recommendations, the Assistant Director of Agriculture was selected. Altogether, twelve key informants were selected and interviewed across two districts. A mix of different key informants helped to develop a broader understanding of the research topic. The details of the key informants interviewed are given in Table 3.1.

Table 3-1: Basic information of the key informants

S/N	Key Informant	Affiliation	Number interviewed
1	Deputy Provincial Director Agriculture Central Province	Provincial Department of Agriculture, Peradeniya	1
2	Assistant Director of Agriculture	Department of Agriculture, Nuwaraeliya	1
3	Agricultural Instructor (Thalathuoya, Kandy)	Department of Agriculture	1
4	Agricultural Instructor (Marassana, Kandy)	Department of Agriculture	1
5	Agricultural Instructor (Dalpitiya, Kandy)	Department of Agriculture	1
6	Agricultural Instructor (Nuwaraeliya)	Department of Agriculture	1
7	Agricultural Research and Production Assistant (Nildandahinna, Nuwaraeliya)	Department of Agrarian Development	1
8	Extension officer	A.Baurs Private Limited	1
9	Extension officer	CIC Private Limited	1
10	Secretary, Farmer Organization	Farmer Organization, (Narangasthenna, Thalathuoya, Kandy)	1
11	Secretary, Farmer Organization	Farmer Organization (Bolapa, Thalathuoya, Kandy)	1
12	Vegetable Farmer	Doragala, Kandy	1

Once the key informant interviews did not add new data, the researcher moved to Phase III in this study.

3.7.2 Selecting vegetable farmers in Phase III

Phase II helped the researchers to understand the nature and extent of diversity among the farm household strategies and their resources, which gave insight into who to select as respondents in Phase III. Farm households who received, or are receiving, a major portion of their household income from vegetables were the focus of the research. However, later what emerged was the reliance on vegetables as an income source was varied across farm households.

Agricultural Instructors [10](AI) had regular and close contact with farmers. The AIs for the Kandy and Nuwaraeliya districts provided lists containing the names and contact details of farmers who were significantly dependent on vegetables. There were 31 farmers on the list from Kandy, and 24 farmers were on the list received from Nuwaraeliya. Selecting farm households was purposive to achieve the research objectives. The AIs were requested not to include any farmer on this list who may be traumatised by an interview due to their distressing experiences during the pandemic, either at the personal or household level. Once the researcher received the farmer lists, it was double-checked with the AIs to ensure the list did not include such extreme cases. Once it was confirmed, farmer participants were randomly selected from the list. None of the farmers contacted declined to participate in the study.

Thirty-two farmers (Table 3.2) from both districts were interviewed; eighteen from Kandy and fourteen from Nuwaraeliya. The following section will describe data sources and explain the procedure for developing interview guides and the interview process.

[10] Field-level agricultural extension officers from the Department of Agriculture

Table 3-2: List of vegetable farmers interviewed in Phase III

S/N	Gender	Age (years)	Area under vegetables (ha)	Experience in veg. cultivation (years)	Other livelihood activities by farm household members
K1	Female	65	0.10	40	Paddy farming, maintaining home garden, son – working as a clerk
K2	Male	55	0.20	25	Paddy farming, received pensions, private sector employee, Two children -private sector employees
K3	Male	60	>0.40	40	Pepper, seasonal farm labourer, son-government employee
K4	Male	61	0.40	30	Paddy farming, renting out farm equipment, leasing out lands, wife-teacher
K5	Male	75	0.40	50	Pensions, *Ayrwedic* (Traditional) doctor
K6	Male	77	0.40		Paddy farming, cultivating ginger, turmeric, pepper, farmer pensions
K7	Male	57	1.00	40	-
K8	Male	39	0.40	20	Working in a landscaping company
K9	Male	52	0.70	34	Daughter- working in a textile factory
K10	Male	50	0.40	30	Selling milk
K11	Male	50	0.07	10	Carpenter, son-electrician, daughter I-teaching, daughter II- works in a textile company
K12	Female	50	0.20	05	Cultivating turmeric, pension payments to husband (retired army officer)
K13	Female	47	>0.40	10	Cultivating turmeric, cultivating and selling fruit crops, livestock
K14	Female	46	0.60	20	Cultivating tea, selling poultry manure and compost
K15	Female	54	0.40	20	Paddy farming, cultivating tea, coffee, brother's wife- government employee

K16	Male	40	0.50	20	Cultivating Tea, providing transport services, cultivating cardamom
K17	Male	55	0.50	30	Cultivating tea, livestock
K18	Female	52	0.05	08	Paddy farming, cultivating tea, coffee, pepper, husband- casual labourer
N1	Male	61	0.60	50	-
N2	Male	50	2.00	10	Provincial council employee (Semi-government)
N3	Male	48	0.60	20	
N4	Male	37	0.80	15	Seed potatoes production
N5	Male	37	0.40	15	Livestock (rearing goats)
N6	Male	44	0.30	17	Providing transport services through a three-wheeler
N7	Male	31	0.25	07	
N8	Male	50	0.80	25	-
N9	Male	65	0.40	40	-
N10	Female	59	0.40	20	Paddy farming, cultivating pepper, government employee, running a grocery store
N11	Male	38	0.20	20	Paddy farming, casual labour in the village, migratory labour
N12	Male	37	0.40	15	Paddy farming, running a canteen in the school and hospital, working as a driver in a distant area
N13	Male	75	0.10	50	Paddy farming, cultivating pepper
N14	Male	50	0.80	20	Government employee, spouse-government employee, unmarried daughter- teacher training, unmarried son-provincial council employee

3.8 Data

Data was collected from multiple sources in this study. Using multiple data sources in qualitative research provides a valuable and in-depth understanding of the phenomena of interest. Interviews,

documents, and unstructured observations were used to collect data in this study. These data collection methods are acceptable for case study based qualitative research (Barrett & Twycross, 2018; Heale & Twycross, 2018; Polkinghorne, 2005). Use of multiple data sources is helpful to improve the richness of the information obtained on the phenomena of interest (Donkoh & Mensah, 2023).

Respondents were interviewed to obtain a detailed and complete account of their experience. It is a powerful tool for eliciting narrative data that helps researchers study respondents' views deeply (Alshenqeeti, 2014; Polkinghorne, 2005). Since this study acknowledges that multiple realities exist, each interview was considered unique and contained the farmers' own experiences with the pandemic. This was according to the constructivist-interpretivist research paradigm used in this study, which clearly acknowledges that reality is not the same but varied across individuals. Interviewing different people to collect different opinions and experiences, using several techniques in each interview such as recording and transcribing interviews, asking clarification questions from the respondents, maintaining objectivity and debriefing the analysis of the interviews to the supervisors helped to ensure the rigour of this study (Coleman, 2022; Long & Johnson, 2000).

Semi-structured interviews were found to help broaden the understanding of the investigated research area (Alshenqeeti, 2014). Semi-structured interviews also allow the interviewer to probe and expand the interviewee's responses to ensure a deep understanding (Sofaer, 1999). Deep understanding was required to untangle the link between household resources and coping strategies.

Document analysis complemented the findings from the interviews, as documents are usually used to triangulate the information (Bowen, 2009; Denzin & Lincoln, 2008). Different forms of documents can be used in qualitative research (Bowen, 2009). Different types of documents (textbooks, newspapers, promotional materials and letters) can be obtained from different sources (libraries, the World Wide Web and academic institutions) (Donkoh & Mensah, 2023). This study included government documents and media articles (Appendix E). Continuous government and private media updates on

developments in COVID-19 pandemic management in Sri Lanka provided a rich data source for this study to understand the context and to plan data collection.

Unstructured observations while conducting interviews helped to understand the research context, how farm households produce and market vegetables, and the nature of their household resource settings. Unstructured observations are associated with the constructivist-interpretive paradigm that acknowledges the importance of the context and co-creation of knowledge by the researcher and the respondent (Mulhall, 2003). Analytical memos were also developed along with the data collection based on the researcher's reflections on the data, which was helpful in the data analysis stage (Kalpokaite & Radivojevic, 2019; Miles, 2020).

3.8.1 Developing interview guides

The questions and topics to be covered in the interview were incorporated into an interview guide. An interview guide provides a plan for the interview, but it is also flexible to accept new information from the respondent (Yow, 1994). Questions for the interview guide were prepared through a careful thought process. Prior knowledge of the research topic is required before formulating the questions for the interview (Kallio et al., 2016). Based on the preliminary understanding obtained in the scoping phase of the context of farm households, the impact of the pandemic, and the research objectives, the researcher developed two interview guides: one for the key informants and the other for the farm households. Both guides contained open-ended questions. The key-informant interview guide (Appendix C) had two sub-sections: section one on contextual information and section two on COVID-19 impact on vegetable farmers and their households and farmer responses. Changes in vegetable production, marketing, and farmer households were ascertained using open-ended questions. How farm household responses to the impacts were shaped by household capital was also collected. The vegetable farmer interview guide (Appendix D) contained three main sub-sections: changes in vegetable production and marketing before and after COVID-19, changes in households during the

pandemic, and socio-demographic information. Open-ended questions were developed in each sub-section to achieve the research objectives.

3.8.2 Interview process

All the interviews were conducted by the researcher using the *Sinhala* language; one of the main local languages. The interview process involved several communication methods. Depending on the COVID-19 restrictions in the study period, the researcher could conduct only some face-to-face interviews, while remaining interviews were conducted over the telephone or Zoom. In phase II and Phase III, there were a few interviews which used telephone or Zoom interviews followed by face-to-face interviews. It happened because, during the field visits for other face-to-face interviews, the researcher could also physically meet some of the respondents who were previously being interviewed over the telephone or zoom. Table 3-3 shows the number of interviews conducted in each method in each phase.

Table 3-3: Number of interviews conducted in each phase using different methods

Phase	Total number of interviews	Face-to-face	Telephone	Zoom
Phase I (farmers)	10	0	10	0
Phase II (farmers and officers)	12	5	5	4
Phase III (farmers)	32	21	12	0

Previous studies that explored resilience in post-disaster contexts, where community access was difficult and unsafe, have used telephone interviews to collect data (Jones & von Engelhardt, 2020). A potential disadvantage highlighted by Jones & von Engelhardt (2020) in the use of telephone in data collection is the shorter period of contact between the researcher and the study participants that occurs in telephone interviews, compared to face-to-face, and it may impact the level of mutual trust

(Jones & von Engelhardt, 2020). Lack of trust on the researcher might interrupt capturing the reality of farm household context during the pandemic. Virtual communication platforms such as Zoom and WhatsApp were also used to enhance trust when participants had access to those technologies. The researcher used tools, such as WhatsApp and email, to share the documents with respondents (e.g. data collection guide, information sheets, and consent form) and to receive data from the respondents (e.g. sharing farmer list), where necessary.

The interview process was quite similar to that of the key informants and the vegetable farmers, except for the reasons for interviewing in each phase. The reasons for conducting key-informant interviews included: i) to identify the types of impacts of the pandemic on farm households, ii) to identify the diversity of impact on farm households and the reasons for the differential impact, iii) to identify the types and mix of strategies that farm households have used to respond to the pandemic impacts and iv) to understand why did they use such strategies. Key informant interviews helped to identify the farm households for the interviews in Phase III. The purpose of interviewing farmers was to gain an in-depth understanding of the pandemic impact on and the farm household response to the impacts. Both types of interviews were supported by an interview guide with more open-ended, general questions. The key informant interview took about 1.0 to 1.5 hours, while vegetable farmer interviews took about 40 to 45 minutes.

In both types, the researcher first contacted the respondent over the phone, introduced herself, and briefed the focus of the research. The researcher obtained verbal consent from the respondent to participate in the study, as also practised by other scholars (Manlosa et al., 2019). Then, an appointment was made with the respondent for the interview. The information sheet (Appendix A) and consent form (Appendix B) were shared with the respondents through email and WhatsApp. When the respondents did not have access to email or WhatsApp, an information sheet and consent forms were handed over to the respondents on the day of the face-to-face interview.

The first key informant interview was conducted on the 01st of September 2021, from 9.00 am to 10.00 am in Sri Lankan time. After a preliminary discussion to build rapport (Unnithan, 2021), the researcher asked the respondent's permission to audio record the interview (Manlosa et al., 2019; Polkinghorne, 2005). Once this was agreed upon, the researcher began the interview. The order of the questions in the interview guide was followed. However, as Yow (1994) suggested, when respondents expressed their experiences with the pandemic spontaneously, the information was recorded. This flexibility ensured the collection of as much data as possible, whether in reply to the interview guide or voluntarily. Notes were taken if any new information emerged except for the topics in the interview guide. As the researcher worked through the questions, clarification questions (Irvine, Drew, & Sainsbury, 2013) were asked when required to ensure the researcher understood what the respondents were saying and, probing questions were asked to provide more detail, as suggested by Manlosa et al. (2019). Once the interview was completed, the researcher thanked the key informant. If there was any follow-up information provided by the respondents, it was shared with the researcher through email or WhatsApp. In each face-to-face interview, observations were also made and noted down, and this data was helpful for analysis.

There were two instances where the researcher had to adapt to the context that emerged in the field. To interview the farmers, the researcher made an appointment to visit one selected person on a particular day. However, there were two instances where the researcher had to adapt the interview procedure and conduct informal farmer discussions. These two situations happened when the researcher arrived at the agreed place and discovered the selected farmer invited other farmers to the interview. One such discussion took place in a community centre in Marassana in the Kandy district with the participation of five vegetable farmers, whereas the second discussion took place in a farmer’s house in Madulla in the Nuwaraeliya district with four vegetable farmers. These discussions added interesting insights that supported data collected from individual farmer interviews.

The researcher first introduced herself and explained the focus of the study, the information sheet, and the consent form to the farmers. Then, she followed the questions in the farmer interview guide, giving the participants more freedom to express their experiences during the pandemic. In a qualitative study, interviewing would not be a uniform, standardised or replicable process; instead, each interview is unique where the respondent expresses their experiences in their own words (Taylor, 2005). Being flexible with data collection protocol helped the researcher to discover new information in these group discussions. Another advantage of these impromptu discussions was that they helped to enrich the data collected from individual farmers. Although this was a group discussion, some farmers expressed their personal experiences and strategies during the pandemic, and that information supplemented the data collected from individual farmer interviews. Discussions with farmers were audio-recorded with the participant's consent and took about 1.0 to 1.5 hours per discussion. At the end of the discussion, the researcher thanked the participants.

3.9 Data analysis

The interview data was analysed using qualitative methods, and thematic analysis was used. Thematic analysis is a 'method for systematically identifying, organising, and offering insight into patterns of meaning (themes) across a data set, and it allows the researcher to see and make sense of collective or shared meanings and experiences (Braun & Clarke, 2012, p.57). According to Dey (2003), qualitative data analysis is an iterative process of describing data, classifying data, and connecting categories (Dey, 2003). This study adopted the process used by Dey (2003). Process of data analysis is shown in the Figure 3-2.

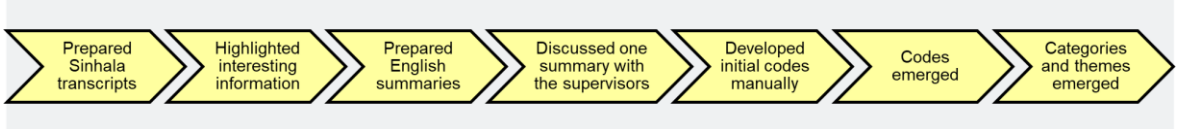

Figure 3-2.Process of data analysis

First, the researcher transcribed all the audio-recorded interviews using *Helakuru* and *OTranscribe* software. Mechanical recording of the interviews and transcribing them was helpful in capturing 'rich' data and ensuring the credibility of this study (Coleman, 2022). Since all the interviews were conducted in the Sinhala language, the researcher used *Helakuru* (Dissanayake et al., 2022) software to type the transcript on the computer. Meanwhile, *OTranscribe* software was used to play the audio because *OTranscribe* had the option to alter the audio's speed, making simultaneous listening and typing in the *Helakuru* a less challenging task. As Widodo (2014) argued, transcription helps convert digitally available interview data into visible transcripts (Widodo, 2014). The researcher had to go through the audio recording several times to complete the transcript, which was a valuable exercise to understand the data that emerged in each interview (Bailey, 2008). While transcribing, the researcher noted down separately any duplicated information. If there were any other related information linked to that piece of information or if there was new information, they were also noted down.

Once all the interviews were transcribed, information related to the research question was highlighted manually in the printed hard copy of each transcript. Then a summary of each transcript was prepared in the English language. This was to describe the data as suggested by Dey (2003). Preparing summaries involved careful re-reading of the interview transcripts. One summary was discussed with the supervisors and after careful in-depth discussion, initial codes were developed for the impact and strategies. ' Codes' are descriptive labels generated by the researcher and assigned to data 'chunks' (Miles, 2020). This coding process provided '*…a deep reflection about and, thus, a deep interpretation of the data's 'meaning'* (Miles, 2020). It is an interpretive act that can sometimes summarise, distil, or condense data (Saldaña, 2021). Although there are different coding methods in qualitative data analysis, this study used manual coding method to capture how vegetable farm households expressed their experience with the pandemic and their responses to the pandemic impacts. The similarities or differences among vegetable farmers regarding pandemic impacts, farmer response, and factors affecting farmer response were also coded.

These initial codes were transferred to an MS excel spreadsheet. Transferring the data to MS Excel helped in checking the patterns across the data. When the researcher went through the remaining summaries, further codes emerged, and sometimes initial codes were changed. When new codes were developed, they were again discussed with the supervisors. These discussions were held to ensure that the codes exactly reflected the data collected. English summary and Sinhala transcripts were referred to repeatedly to confirm that codes reflected the data in the transcripts.

An example of the initial codes and final codes in the coding process is illustrated in Figure 3-3.

positive and negative Impact during this period	codes	codes	2nd level codes
could not buy seeds and pesticides as shops were closed during lockdown	could not buy inputs	Access to inputs	Decreased production
could not travel to the city to purchase seeds and pesticides	could not buy inputs	Access to inputs	Decreased production
could not purchase pesticides on time dealers could not travel from colombo due to lock down	could not buy inputs	Access to inputs	Decreased production
lack of pesticides during lockdown due to low supply	could not buy inputs	Access to inputs	Decreased production
high prices of wormicides for potatoes now	high input prices	high cost of inputs	Increased COP
high prices for chemicals for diseases now	high input prices	high cost of inputs	Increased COP
high prices of fungicides now	high input prices	high cost of inputs	Increased COP
lack of fungicides now		Access to inputs	Decreased production
vegetables traders did not come to collect vegeatbles during lockdown	loss of markets	loss of markets	loss of markets

Figure 3-3.An example of the coding process

After a careful iterative process, final codes were developed. The codes for the impact included financial impact and household wellbeing impact while codes developed for the coping strategies included production strategies, marketing strategies and financial hardship strategies (to respond to decreased household income and increased household costs). The categorisation of codes was done based on the cause-and-effect relationship. For example, financial impact has two categories as increased costs and decreased income which were further categorised. Finally, themes were identified

as described by Saldaña (2021). These codes on impacts and strategies will be explained in the results chapter.

3.10 Ethical concerns

Following ethics in social research is an important practice, and it is often defined as 'doing no 'harm' (Miles, 2020; Piper & Simons, 2005). Obtaining informed consent from the research participants, maintaining confidentiality and anonymity, and publication access have been identified as some of the traditional and important ethical obligations in research (Piper & Simons, 2005).

This study did not involve any physical or psychological harm to the respondents as precautions were taken to avoid interviewing farmers extremely hard hit by the pandemic, as the interview might have retraumatised such farmers. Therefore, an ethics application was submitted to the Massey University and this study was evaluated by peer review and judged to be low risk. This study adhered to the guidelines outlined in Massey University Code of Ethical Conduct for Research, Teaching & Evaluations Involving Human Participants. The researcher fully protected study participants' right to participate and withdraw from the study at any time if they wished to. Participants were fully informed about the purpose of the study by sharing the information sheet (Appendix A) with them in advance. Participation in the study was voluntary, and participants' consent was obtained using the consent form (Appendix B). Participants were explained the benefits they would receive in participating in this study.

The confidentiality of individual respondents was protected, and when presenting results, pseudonyms were used to protect the anonymity of respondents. Interviews were not audio recorded if a participant disagreed, or audio recording was paused when a participant wanted to share certain information only with the researcher.

3.11 Conclusion

The methodology chapter described the research design used in this study. This study was an exploratory, single case study that followed a constructivist-interpretive approach. Vegetable farm households in Nuwaraeliya and Kandy districts were purposively selected as the case. This study consisted of three phases: the scoping phase, the key-informant interview phase, and the farmer interview phase. Respondents for the interviews were purposely selected, and twelve key informant interviews and thirty-two vegetable farmer interviews were conducted, representing both study sites. Conducting interviews abides by the ethical principles outlined in the Code of Ethical Conduct for Research, Teaching & Evaluations Involving Human Participants. Additionally, two farmer discussions were held; one each in Kandy and Nuwaraeliya districts. Data was analysed using thematic analysis.

The following chapter on case description will describe the case used in this single case study.

4) CASE DESCRIPTION

4.1 Introduction

This chapter mainly consists of two sub-sections: the study area and research context. The first sub-section will describe the Central Province's general information, followed by the geographical information, demographic information, agricultural and livelihood activities of the people, and vegetable production and marketing- related information in the Kandy and Nuwaraeliya districts. The second sub-section will outline the research context in which this study was conducted. This study was conducted during the COVID-19 pandemic period. Therefore, this section will also outline the situation before the spread of COVID-19 in Sri Lanka and the situation that emerged during the COVID-19 pandemic in Sri Lanka, which had specific implications for respondents in this study.

4.2 Study area

This section will describe the general information and vegetable production and marketing-related information in the Central Province, specifically in the Kandy and Nuwaraeliya districts.

4.2.1 Overview of the Central Province

The Central Province is located in the central hills on 6.6°- 7.7° Northern latitude and between 80.5°-80.9° Eastern longitudes with elevation ranges from 600ft to over 6000fts (182 m to over 1820m) above sea level (Central Provincial Council, 2023). The province's land area is 5,674 km^2, which accounts for 8.6% of the total land area of Sri Lanka, and consists of three districts: Kandy, Nuwaraeliya and Matale (Central Provincial Council, 2023). The population of the Central Province represents 12.6% of the country's total population, and people are employed in services (43.8%), agriculture (33.1%) and industry (23.1%) sectors (Department of Census and Statistics, 2012, 2021).

The area experiences a cool, mild climate with a mean temperature range from 16°C to 28°C (Central Provincial Council, 2023). The agro-ecological characteristics of the Central Province represent the wet

zone and intermediate zone. Therefore, it is suitable for different types of crops and livestock. About 52% of the land in the province being cultivated (Central Provincial Council, 2023) with tea, paddy, vegetables, export agricultural crops, and floricultural products, the predominant crops. The Central Province also contributes to the national dairy industry (Gunawardana et al., 2014).

4.2.1.1 Vegetable production in the Central Province

Vegetables are the main food crop cultivated in the Central Province and the scale of cultivation, types of crops grown, cropping cycle varies with the topography and climate in the different areas of the province. The largest share of the upcountry vegetables are produced in this region. Upcountry vegetables cultivated are mainly cabbages (*Brassica oleracea*), carrot (*Daucus carota*), leeks (*Allium ampeloprasum*), beetroot (*Beta vulgaris*), radish (*Raphanus raphanistrum* subsp. *sativus*), knoll khol (*Brassica oleracea var. gongylodes*), and lettuce (*Lactuca sativa)* (Weerakkody & Mawalagedera, 2020). Some low-country vegetables are also cultivated in some parts of the province.

Vegetable production in the area is susceptible to extreme weather events, damage from wild animals, and damage from pest and diseases. The 2020-2021 agricultural extension plan for the Central Province identified a few bottlenecks in vegetable farming in the province, such as low land productivity, low quality of vegetable products due to pest and diseases, difficulties in vegetable marketing, damages due to unfavourable environmental conditions and trends in abandoning vegetable lands. Therefore, various programmes such as conducting soil testing, and crop clinics, farmer training, establishing GAP farms, identifying marketing opportunities and promoting tunnel vegetable production were planned to mitigate those challenges (Provincial Department of Agriculture, 2021).

Inputs and service supply in vegetable production is associated with different government and private sector organisations and will be discussed in later subsections.

4.2.2 Overview of Kandy district

Kandy district covers 1,940 km^2 of land area and served as an ancient kingdom in Sri Lanka (Department of Census and Statistics, 2022c). It is located at 100m to 1,600 m above sea level in between North Latitude 60.560 and 70.290 and East Longitude 80.250 and 80.000. The average annual rainfall and temperature in Kandy district is 1,840 mm and 20°C - 22 °C, respectively (Department of Census and Statistics, 2022c).

The population in the Kandy district is 1,368,216, and this represents 6.7 % of the country's total population (Department of Census and Statistics, 2012). Most of the population lives in rural[11] areas (81.4%) while 12.4% and 6.2% live in urban and estate sectors, respectively (Department of Census and Statistics, 2022c). The labour force participation rate[12] in Kandy district is 48.2 and people are employed in agriculture (19%), industries (25.5%) and services (55.5%) sectors (Department of Census and Statistics, 2021).

The average household expenditure on food and beverage in Kandy district is Rs. 21 ,632 (Sri Lanka – Rs. 22,130), and the food ratio[13] is 32.3% (Sri Lanka- 35.1%) (Department of Census and Statistics, 2019). Household's non-food expenditure spreads across housing (20.6%), fuel and light (4.5%), personal care and health expenses (5.5.%), transport (11.7%), communication (2.7%), education (5.4%), cultural activities and entertainment (2.6%), household non-durable goods and household

[11] There are three main residential sectors in Sri Lanka known as urban, rural and estate sectors. The areas governed by municipal councils and urban councils are considered as urban areas, and plantations with more than 8 ha and not less than ten residential labourers are considered as estate sectors. All the residential areas that do not belong to either the urban or the estate are considered as rural areasDepartment of Census and Statistics. (2019). *Household Income and Expenditure Survey*. http://www.statistics.gov.lk/IncomeAndExpenditure/StaticalInformation/HouseholdIncomeandExpenditureSurvey2019FinalReport

[12] Labour force as a percentage of the population aged 15 years and above Department of Census and Statistics. (2021). *Sri Lanka Labour Force Survey Annual Report*. http://www.statistics.gov.lk/LabourForce/StaticalInformation/AnnualReports/2021

[13] The ratio of household expenditure on food and drink to total household expenditure given as a percentage

services (2.0%), clothing, textiles and footwear (3.9%), household durable goods (10.4%), and other miscellaneous expenses (16.5%)(Department of Census and Statistics, 2019).

Kandy district's administration consists of 20 Divisional Secretary (DS) divisions[14]. Each DS division consists of smaller administrative units; *Grama Niladhari* (GN) divisions totalling 1,188 [15](Department of Census and Statistics, 2022c). This study was conducted in Thalathuoya and Marassana GN divisions in Pathahewaheta DS division. There are 19,308 households in Pathahewaheta DS division which represents 4.6% of district population (Department of Census and Statistics, 2020a).

According to Household Income and Expenditure Survey 2019 final report, the mean household income per month in Kandy district is Rs. 74,821, slightly below the national corresponding value (Rs. 76,414) (Department of Census and Statistics, 2019). About 5.6% of household income is from agricultural activities whereas, wages or salaries (36.3%), non-agricultural activities (18.6%), other cash income (16.8%), income by chance or adhoc gains (7.1%) also contribute to household monetary income (Department of Census and Statistics, 2019). Other cash income includes pensions, disability payments, *Samurdhi*[16] payments, local and foreign transfers (Department of Census and Statistics, 2019).

4.2.2.1 Land use and agricultural activities in Kandy district

Tea, paddy, turmeric, vegetables, and export crops such as pepper, cloves and coffee are the main crops cultivated in the district. About 34.8% of the land has been cultivated and 21.7% of the land is covered by forest. About 43.5% of land is not being cultivated (Department of Census and Statistics, 2022c).

[14] Highest level of local administrative unit within a district
[15] Smallest local administrative unit at the village level
[16] *Samurdhi* programme is the national poverty alleviation programme and *Samurdhi* officers are involved in implementing this programme at the field level

Tea has been cultivated on 52,591 acres (21,282 ha) with 40% belonging to the small holding sector and 60% grown by the estate sector (Department of Census and Statistics, 2022c). Some livestock activities are also available in Kandy district (Ibrahim & Zemmelink, 2000). Agricultural activities in the district have been disrupted by different disasters within the last decade, including floods, landslides, storms, droughts, damage from wild animals, fires, and drying of water springs (Department of Census and Statistics, 2020a).

Vegetable production and marketing in Kandy district

Vegetable production is mainly operated as a rice-based vegetable cropping system (Weerakkody & Mawalagedera, 2020). Farmers in Kandy district cultivated a mix of upcountry and low country vegetables. There is a lack of data on the number of vegetable farmers in the Kandy district. Nevertheless, there are about 4,300 all types of farm households and 694 vegetable farmers in the Thalathuoya Agrarian Service Division area and the expected area under vegetable cultivation was 148 ha in 2021/2022 Maha season (Interview with agricultural officers Kandy). In the Thalathuoya Agrarian Service Division area, about 40 % of farmers cultivated vegetables full time while the remainder were part-time farmers. Full time vegetable farmers are mainly older with no or limited other livelihood activities, whereas part time vegetable farmers were middle aged and also were involved in non-farm jobs (Department of Agrarian Development official). Although there might be slight variations, vegetable farm households in Kandy district can be categorised as small, medium and large scale based on the extent of land area under vegetables. Small scale farm households cultivated 0.1 to 0.8 ha land while medium scale farm households cultivated 0.8 to 1.6 ha of land. There was a limited number of large-scale farm households who cultivated vegetables on land above 1.6 ha (personal communication with Department of Agriculture officials Kandy).

Vegetables are cultivated in the lowlands, highlands and in *Chena* (slash and burn) cultivation in the Kandy district (Figure 4-1). There are a mix of upcountry and low country vegetables cultivated in Kandy and there is also variation in farm households' involvement in vegetable production throughout

the year. Some farm households cultivate vegetables in both the Yala and Maha seasons while some cultivate only in the Maha season as they experience water scarcity in Yala season. Farm households who cultivate vegetables only in Maha seasons are involved in non-farm and off-farm activities (e.g. working as labourers in other vegetables farms) during the Yala season. During the Maha season, farm households who cultivate both paddy and vegetables, cultivate paddy in the lowlands, and vegetables in the highlands. In the Yala season, they cultivate vegetables in the lowlands. Yala is the predominant vegetable cultivation season for some areas. In Maha season, farm households who do not have paddy, cultivate vegetables in the highlands which are often located near the farmers' house or on *chena* lands. The ownership of land varied among farm households and some farm households cultivated vegetables on their own lands while others cultivated vegetables on leased lands.

Farm household in some areas in Kandy (e.g. Doragala) start their vegetable season in March each year. There is a slight difference in the vegetable cultivation season in the Thalathuoya and Marassana areas. In Marassana, the vegetable cultivation season begins in August each year, followed by the paddy cultivation season in November. August is usually a dry month and farm households in Marassana prepare their *chena* lands, and plant seeds in nurseries at the beginning of the month, then start field planting with the onset of rains. Once the vegetables are harvested farm households leave *chena* lands fallow.

Figure 4-1.Luffa cultivation in Kandy (source: Author)

When farm households in Thalathuoya cultivate both paddy and vegetables, they give priority for paddy cultivation. Paddy is the staple food in Sri Lanka and Kandy farm households cultivate paddy only for home consumption. Therefore, when the paddy cultivation season and vegetable season overlap, farm households prioritise over paddy and begin paddy cultivation with the onset of rains. Consequently, when they begin to cultivate vegetables, the area may not receive adequate rain for favourable vegetable growth. This highlights the diversity of vegetable production systems in the Kandy district, its sensitivity to the climate, and the importance of vegetable production to farm households as a livelihood activity.

Both upcountry and low country vegetables are cultivated in Kandy district. The extent of cultivation and amount of production of some upcountry (cabbages, carrot, beetroot, leeks) and low country (luffa, brinjal, long bean, bitter gourd) vegetables in Kandy district in 2022, are given in the Table 4.1.

Table 4-1: Land extent and production of some vegetables in Kandy district, 2022

Type of crop	Extent in ha			Production in MT		
	Yala	Maha	Total	Yala	Maha	Total
Cabbage	213	157	369	4046	2307	6352
Carrot	46	44	90	1031	263	1293
Beetroot	11	8	19	144	105	250
Leeks	16	24	41	309	321	630
Luffa	85	75	160	1013	804	1818
Brinjal	201	218	419	2983	2729	5712
Long bean	142	135	277	1207	1160	2367
Bitter gourd	69	88	157	836	1025	1861

Source: (Department of Census and Statistics, 2023a)

Farm households use different marketing channels to sell their vegetables, including selling to middlemen and selling to local and distant markets (Figure 4.2). These middlemen include vegetable collectors in the village and vegetable collectors coming from other areas. There are other middlemen involve along the marketing channel.

Farm households had varying viewpoints on selling to different types of middlemen. Selling to middlemen coming to the farm field perceived to saves the farm household's time which they could use for some field work. However, when selling to these middlemen farm households do not receive immediate cash and the prices they receive is often low. Therefore, some farm households transport their own vegetables to the local and distant markets by themselves where they get needed immediate cash and a comparatively fair price. Some farm households who transport vegetables long distances to distant markets follow post-harvest handling practices (e.g. use of wooden boxes to transport vegetables) to minimise the losses during transportation.

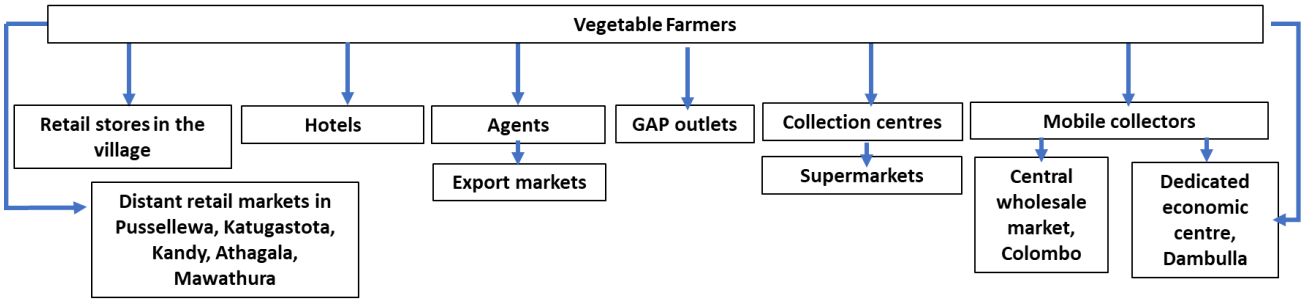

Figure 4-2.Vegetable marketing channels in Kandy district

4.2.3 Overview of Nuwaraeliya district

Nuwaraeliya is located in the central hills and served as a commercial city in the upcountry during the colonial period. The land area of the district is 1,741Km^2 (Department of Census and Statistics, 2022d). There are five DS Divisions and 491 GN divisions in Nuwaraeliya district (Department of Census and Statistics, 2020b). Primary data for this study was collected form Nuwaraeliya and Walapane DS divisions. The population in Nuwaraeliya district is 706,210, representing 3.5% of the Sri Lankan population, with 78% of them living in the estate sector (Department of Census and Statistics, 2012, 2022d). The labour force participation rate in Nuwaraeliya district is 57.1 and people are employed in the agriculture (57.%), industries (17.0%) and services (25.9%) sectors (Department of Census and Statistics, 2021).

The mean monthly household income in the district is Rs. 54,504 (Department of Census and Statistics, 2019). About 12.1% of household income is derived from agricultural activities whereas households benefit from other monetary income sources as wages/salaries (53.1%), non-agricultural activities (10.1%), other cash income (8.6%), and income by chance/adhoc gains (1.3%) (Department of Census and Statistics, 2019). According to official data, agricultural activities' contribution to household income is higher in the Nuwaraeliya district than in the Kandy district.

The district's average household expenditure on food and beverage is Rs. 21,037 (Department of Census and Statistics, 2019). Households in the Nuwaraeliya district spend the highest on cereals,

compared to the households in other districts. Rice and wheat (flour) represents the main types of cereals consumed in households in the tea plantations in Nuwaraeliya district (Samarasinghe, 1993). Because these foods are more affordable than many other foods. The food ratio of households is 50.1%, which means that households in the area spend equally on food and non-food expenses (Department of Census and Statistics, 2019). Among the household non-food expenditure, households spend the island wide highest for housing (30.5%) and liquor, drugs and tobacco (6.8%)(Department of Census and Statistics, 2019).

4.2.3.1 Land use, agricultural activities and livelihoods in Nuwaraeliya district

About 36.67% of the land in Nuwaraeliya district has been cultivated while 43.32% of the land is covered by forest (Department of Census and Statistics, 2022d). The cool and temperate climate in Nuwaraeliya is favourable for crop cultivation and livestock farming. Tea, vegetables, and flowers are the main crops cultivated in the area. Commercial tea cultivation in the large estate sector and privately owned tea lands began in the British colonial period and continued to date. Nuwaraeliya is a prominent area of upcountry vegetable production in Sri Lanka and vegetables are cultivated both in urban and rural areas (Department of Census and Statistics, 2022d). Many farm households in the urban areas in Nuwaraeliya rely completely on vegetable cultivation as a main income source and they are more commercialised than rural farm households. In contrast, some farm households in the rural areas have other on-farm income sources (e.g. cultivating pepper, cultivating paddy) and off-farm income sources (e.g. providing labour, running retail stores, providing transport services).

Cut flower and ornamental flower production, livestock production (e.g. cattle, goat), and ornamental fish farms are some of the other agricultural-based industries which provide livelihood to the farm households in the area. Nuwaraeliya is a tourist hub in Sri Lanka, consequently services associated with the tourism sector, such as catering services, and accommodation services, and tour guides, also provide multiple livelihood opportunities for the farm households.

Vegetable production and marketing in Nuwaraeliya district

Vegetables are produced both at the commercial level and as smallholders. In contrast to Kandy, Nuwaraeliya has a more commercialised vegetable production system. Both upcountry and low-country vegetables are cultivated in the Nuwaraeliya district.

The majority of vegetable farmers are full time vegetable farmers and the types of vegetables cultivated varied across the district. The upcountry vegetables (Figure 4-3) are continuously cultivated in the sloppy lands with high elevation (Weerakkody & Mawalagedera, 2020) while low country vegetables are mainly cultivated in the semi-urban and rural areas with low elevation in the Nuwaraeliya district. In contrast to Kandy farm households, Nuwaraeliya farm households cultivate vegetables on their own lands, leased lands or on the lands owned by private tea estate companies. In contrast to rural farm households, some urban farm households cultivate vegetables on leased lands and some cultivate specialised crops (e.g. parsley, herbs) only for foreign tourists. Many urban farm households have easy access to basic infrastructure facilities (e.g. roads, markets, banks) and services (e.g. financial services) and they also have frequent access to input suppliers and the middlemen involved in vegetable marketing.

Rural farm households do not cultivate vegetables on leased lands nor is there specialised cultivation of particular types of vegetables for tourist market. The majority of rural farm households have difficulties in accessing basic infrastructure facilities, services, input suppliers and middlemen linked to vegetable markets.

Urban farm households can be categorised as large scale (>4.0 ha), medium scale (0.4 to 4.0 ha) and small scale (<0.4 ha) based on the area of vegetable cultivation (personal communication with Department of Agriculture official Nuwaraeliya). However, some rural areas in Nuwaraeliya (e.g. Hanguranketha) the average land area cultivated with vegetables is about 1.0 ha (personal communication with Department of Agriculture official Nuwaraeliya).

Figure 4-3.Vegetable field with leeks cultivation in Nuwaraeliya (Source: Author)

Vegetables are produced all year round with 3 to 4 crops annually (Rathnayake et al., 2022). The land extent and production volume of some vegetables in the district are given in Table 4.2.

Table 4-2: Land extent and production of some vegetables in Nuwaraeliya district, 2022

Type of crop	Extent in ha			Production in MT		
	Yala	Maha	Total	Yala	Maha	Total
Cabbage	1,428	957	2,384	50,758	26,935	77,693
Carrot	1,238	1,204	2,442	32,634	29,907	62,541
Beetroot	341	405	747	4,172	5,163	9,335
Leeks	1,390	1,021	2,412	28,279	15,477	43,756
Luffa	17	84	101	213	947	1,160
Brinjal	209	208	417	4,734	3,506	8,240
Long bean	34	57	91	415	588	1,003
Bitter gourd	22	106	128	400	1,619	2,019

Source:(Department of Census and Statistics, 2023a)

Because of the topography of the land, short crop duration and favourable climate for pest and disease spread, farm households in these vegetable production systems use high amounts of agrochemicals such as fertilisers ,pesticides and fungicides in their vegetable farms (Padmajani et al., 2014; Weerakkody et al., 2009).

Low-country vegetables are cultivated in Walapane and Hanguranketha DS divisions as rice-based seasonal vegetable production system (Department of Census and Statistics, 2022d; Weerakkody & Mawalagedera, 2020). The types of vegetables grown in this system include beans, capsicum, tomatoes, brinjal, cucumber and luffa. These types of vegetables are cultivated in paddy lands during the Yala season when rains are inadequate for paddy cultivation. The land around the homestead is mostly dedicated to pepper therefore no adequate space for commercial vegetable cultivation in highlands.

Marketing of vegetables produced in Nuwaraeliya district involves different stakeholders (Figure 4.4). The Dedicated Economic Centre[17] (DEC) Nuwaraeliya is a main vegetable marketing place in the area. Large scale farm households produce and sell a high volume of vegetables directly to the markets and they sometimes have retail and wholesale vegetable stores in DECs. Therefore, largescale farm households have the ability to influence vegetable market prices. In contrast, the medium and small-scale farm households usually sell to middlemen (i.e. vegetable collectors) and therefore have limited opportunities to influence market prices. Moreover, small scale farm households are highly diversified in their markets because they have different marketing channels.

The majority of farm households sell their vegetables to middlemen (i.e. vegetable collectors who are very often wholesalers), but sometimes farmers' marketing channel varies with the scale of production. Large scale farm households play multiple roles in the vegetable marketing channel sometimes as a vegetable collector who collects vegetables from farm households, or a trader who

[17] The main vegetable market established by the government for vegetable marketing

sells purchased vegetables to a middleman coming from other areas or as a merchant of a vegetable store in the DEC.

Nuwaraeliya DEC slightly differs from other DEC s in the country in terms of mode of operation. Usually in other areas, farm households transport vegetables to the DECs, and the traders in the DEC keep a commission and sell those vegetables. This commission is fixed even for farm households who earn a low income from vegetable selling. In contrast, traders in the Nuwaraeliya DEC visit the farmers and purchase vegetables from them at the farm at an agreed price, set at the beginning of the day. There are about 250,000 kg of vegetables being sold daily to other areas from the DEC Nuwaraeliya (DEC Nuwaraeliya official).

The abundance of hotels and restaurants in Nuwaraeliya as vegetable markets is a unique opportunity for the Nuwaraeliya farm households over the Kandy farm households. The type of market chosen by farm households depends on the volume of harvest, access to the middlemen, price received, distance to markets and access to transport facilities. The type of transporting vehicle also reflects the amount of production. For example, some farm households use a three wheeler (Figure 4.5) to transport a small amount of vegetables to a local market while they may use a lorry to transport a high volume of vegetables to distant markets.

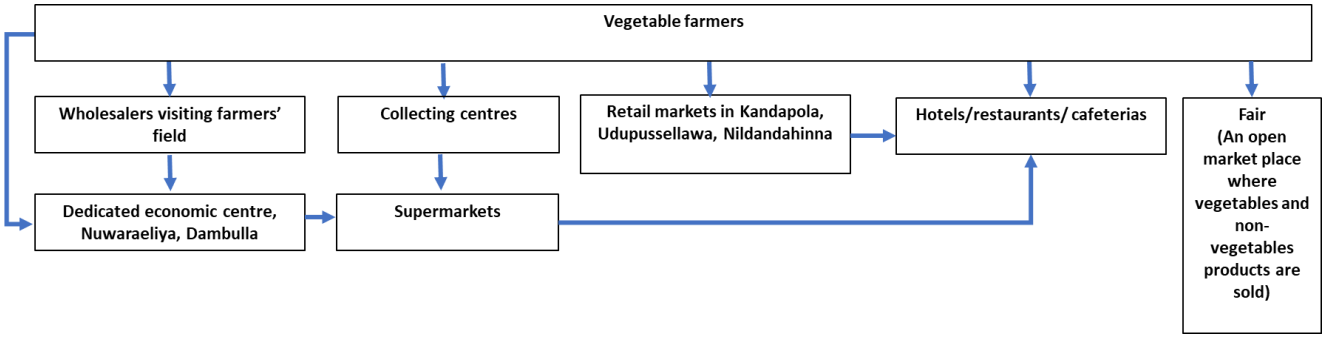

Figure 4-4.Vegetable marketing channels in Nuwaraeliya district

Figure 4-5.A photo of a three wheeler (Source :Author)

There are many middlemen involved in vegetable marketing process (Figure 4-6). An example is shown below:

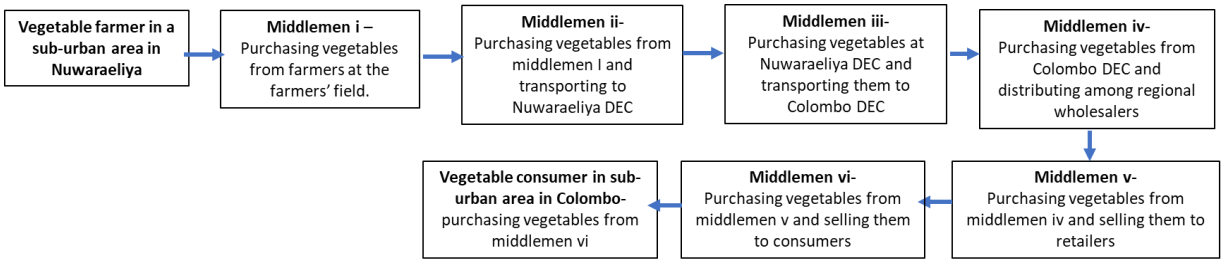

Figure 4-6.Different types of middlemen involvement in vegetable marketing channel

4.2.4 Input supply and service provision for vegetable production

Government and the private sector are mainly involved in inputs supply and service provision for farm households. The Department of Agrarian Development and the Department of Agriculture are the main government organisations facilitating vegetable production and marketing.

4.2.4.1 Role of the Department of Agrarian Development

The Department of Agrarian Development (DAD) provides services related to protecting cultivation rights of farmers, managing agricultural lands, organising farmers, managing rural irrigation systems, and providing agricultural machinery through their village level Agrarian Development Centres. There are 561 Agrarian Development Centres in Sri Lanka and there are two sub-institutes which are the Agrarian bank and the Agrarian Sales Centre (Department of Agrarian Development, 2024). The Agrarian Sales Centre sells farm inputs (e.g. fertilisers, seeds, pesticides, fungicides, herbicides, electric scarecrows) many of which are purchased from private sector input suppliers in Dambulla. The DAD is the body responsible for distributing the fertiliser subsidy[18] among paddy farmers.

The Agrarian Bank provides financial services to farm households in the form of cultivation loans based on a 50% inputs and 50% cash basis. There are several community collectives associated with the DAD. '*Sithamu*' women's society is one such collective operating micro-credit programmes. The society has savings in micro-credit banks in DAD. The society members make a compulsory contribution of Rs.150 each month in those micro-credit banks and the amount of savings the member has, determines the loan amount available from the '*Sithamu*' women's society with the loan accruing interest of 1% per month. There are other community activities organised by the *Sithamu* women's society such as conducting *shramadana*[19] to share the labour and holding fairs to increase the capital of the society.

[18] Chemical fertilisers are provided to paddy farmers at a subsidized rates under the Government's fertiisers subsidy programme

[19] Labour sharing for free

Agricultural Research and Production Assistants (ARPA) are the field level officers in DAD who have direct contacts with farm households. There were 9,500 ARPAs appointed by the government for the first time in 2002, and they were supposed to devote two days per week for field agricultural extension activities. However, these officers were technically incompetent to advise farmers so they were trained by the officers in the Department of Agriculture (Sivayoganathan, 2020). Currently, some ARPAs have an agricultural diploma and involved in organising farmers, supporting the fertilisers subsidy programme, implementing new government agricultural policies and some field extension activities (e.g. compost making, home gardening, floriculture).

4.2.4.2 Role of the Department of Agriculture

The Department of Agriculture (DoA) aim to improve the productivity of the food sector in Sri Lanka. Therefore, the main services and functions of the Department of Agriculture involved agricultural research and technology dissemination, seed and planting material production and distribution and regulatory services (Department of Agriculture, 2024). The technology dissemination is done through conducting different agricultural extension activities (e.g. field training, field days) for farmers by the Agricultural Instructors (AI) belonged to the DoA. The AIs are agriculture diploma holders and they are competent in advising farmers and delivering extension programmes. The main duties of AIs includes technology transfer activities using different methods, conducting crop clinics, linking research organisations and farmers, conducting field trials requested by research organisations, coordinating and conducting community education activities (e.g. home gardening for schools), assisting agricultural administration in the area, and collecting crop production data (personal communication with AI Kandy). The AI also coordinate and implement the GAP[20] programme in the area.

Irrespective of the variety of tasks performed by the AI, one AI has to cover about 2,500–3,500 farm families (Sivayoganathan, 2020) making it impossible for an AI to serve all the farmers in his duty areas.

[20] Good Agricultural Practices programmes operated by the DoA

In 2015, a new cadre position was created as Technical Assistant (TA) and agricultural diploma holders were recruited for this position to work under the supervision of AIs, to support their activities (Sivayoganathan, 2020).

4.2.4.3 Role of the private sector in input supply and service provision

The private sector is also involved in providing inputs and services to farm households, primarily through retail chemical stores and agrochemical companies. Many farm households obtain inputs from the retail chemical stores they have access to; either located in their village or in distant areas. Farm households also receive information on input use and markets from these retail stores selling agro-chemicals (Mahindarathne & Min, 2018).

Agrochemical companies linked to farm households through retail stores and they also conduct extension activities. Unlike the government sector, agrochemical companies are profit-oriented organisations, therefore these extension services are always coupled with product promotion. Agrochemical companies sell their products to retail stores at a lower price than the manufacturer-labelled price. Consequently, retail stores also sell these inputs to farm households at a discounted price (a price lesser than manufacturer's labelled price). This discount farm households receive when they purchase inputs from retail stores in pre-pandemic was about 30%.

The profit-oriented, private agrochemical companies usually use different extension methods for farm households depending on their scale of vegetable production. For example, they conduct brand awareness programmes and demonstrations for small-scale farm households whereas input promotion activities are conducted for the medium and large-scale farm households (key informant interview with private sector extension officer). Some large-scale farm households have an opportunity to receive complimentary inputs directly from private agrochemical companies. In return, these large-scale farm households act as dealers or sub-dealers for agro-chemical companies and they sell inputs to medium or small-scale farm households. Therefore, by acting as middlemen large-scale farm households influence input supply in vegetable production and vegetable markets.

4.3 Research Context

This study was conducted during the period from September 2021 to July 2022. This section will describe the situation in the case study region, beginning with critical events in 2019 and subsequent note-worthy events until July 2022. This section will also briefly describe the government's supportive mechanisms for farm households during the pandemic in Sri Lanka.

4.3.1 The first shock in 2019: The Easter Sunday Bomb Attack

On April 21, 2019, a series of bomb blasts occurred in famous tourists hotels and historic churches across Colombo, the capital city of Sri Lanka and in other areas in the western and eastern regions of Sri Lanka (Amarasingham, 2019). The extremist attacks on Easter Sunday shattered the peaceful nation by killing 270 people and injuring many more (BBC, 2020; Gunasingham, 2019). This tragedy created a black spot in Sri Lankan history and resulted in a precipitous decline in the arrival of foreign tourists, affecting the country's tourism sector. Tourism is an essential pillar of the national economy in Sri Lanka (Robinson & Jarvie, 2008; Sri Lanka Tourism Development Authority, 2020). The number of foreign tourist arrivals in April 2019 was 166,975; and in May 2019, it reduced up to 37,802 - a 77% reduction (Sri Lanka Tourism Development Authority, 2019).

The lack of tourists, both international and national, had a negative impact on food suppliers. This resulted in lesser number of customers in restaurants, hotels and other catering venues, and the demand and price paid for vegetables declined impacting on farm households (Silva, 2019). By 2020, tourism sector of Sri Lanka started to recover from the 2019 Easter attack, but the COVID-19 brought another shock with severe economic consequences (Ariyarathne SMW et al., 2022; Peiris & Thennakoon, 2022). Compared to 2018, international tourist arrivals to Sri Lanka also plummeted by 78 % in 2020 due to the sudden and widespread COVID-19 outbreak and associated travel restrictions (Sri Lanka Tourism Development Authority, 2018, 2020) .

4.3.2 The COVID-19-related shocks occurred from 2019 - 2022

COVID-19 emerged as a novel global pandemic in late 2019, and Sri Lanka reported initial COVID-19 cases relatively soon after it was first identified in China. Three distinctive waves of COVID-19 spread occurred in Sri Lanka (Ministry of Health Sri Lanka, 2022). The first wave lasted from January 27, 2020 until October 3, 2020, the second wave from October 4, 2020 until April 14, 2021, and the third from April 15, 2021 to June 30, 2022 (Ministry of Health Sri Lanka, 2022). In the following section the first and second waves will be explored and the third wave will then be covered in a separate section along with the other shocks that occurred during this wave.

4.3.2.1 The first and second waves of COVID-19

The first COVID-19 case in Sri Lanka was reported on January 27, 2020 (Amaratunga et al., 2020). Consequently, control measures were imposed on the tourism sector in attempt to curtail the spread of the SARS-CoV-2 virus These included, no issuing of on-arrival visas (March 12, 2020), domestic travel bans (March 13, 2020), stopping all incoming passenger flights (March 22, 2020) and social distancing (Robinson & Kengatharan, 2020).

Soon after the cultural New Year[21] break from April 12-17, 2020, the government issued strict health guidelines prohibiting large gatherings in enclosed spaces, including agricultural markets (Ministry of Health and Indigenous Medical Services, 2020). A curfew was imposed, and social gatherings were banned (Hettiarachchi et al., 2021). Many institutions, including schools, universities and most businesses, were placed under lockdown and only health services operated (Hewage et al., 2020) . The curfew was lifted on May 11, 2020 but a ten day national lockdown was declared on August 10, 2020

[21] Sinhalese and Tamils in Sri Lanka celebrate their national new year in April in each year

which was extended to last for about two months. Employees, both from the public and private sectors were asked to work-from-home. Domestic and international travel restrictions were regularly reviewed and updated, depending on the COVID-19 prevalence in the country. The COVID-19 vaccination programme was started on January 29, 2021 (Chief Epidemiologist, 2021).

Agricultural activities were prioritised during this time. Farming and fishing activities were declared essential services, and farmers were permitted to carry out their activities even during lockdowns (Jeevika Weerahewa et al., 2020). They were allowed to engage in field work and to transport vegetables even during the curfew (News First, 2020). Dedicated Economic Centres , where agricultural products were marketed, were allowed to operate while maintaining safety guidelines, such as restricting the number of customers and vendors at any one time, maintaining one metre distance, wearing safety masks, and handwashing (Ministry of Health and Indigenous Medical Services, 2020).

4.3.2.2 The third wave of COVID-19

The third wave of the pandemic was from April 15, 2021 to June 30, 2022 (Ministry of Health Sri Lanka, 2022). The travel bans and lockdowns were lifted in the early part of this period, and as a result all government employees were called back to regular working hours (Hiru News, 2021a). However, this was rescinded after a few days as the deaths from COVID-19 exceeded more than 100 per day in Sri Lanka (Hiru News, 2021b). Likewise, inter-provincial travel restrictions were reimposed on August 14, 2021 (Hiru News, 2021c). A national level lockdown was enforced from September 17 until October 1 2021. The Dedicated Economic Centres were opened only for a few days and the wholesale prices for vegetables were very high. In late September 2021, a scarcity of essential food items such as rice and milk, became evident all over the country.

The data collection for this study (i.e. September 2021-July 2022) took place during this third wave. At the beginning of this period, an unexpected and contentious policy change occurred with respect to

Sri Lankan agriculture. The Government of Sri Lanka issued a gazette notification restricting and banning the importation of synthetic fertilisers and other agrochemicals for agriculture, including insecticides and herbicides, with effect from May 6, 2021 (Mariano J. Beillard & Ayodya Galappattige, 2021). According to the President of Sri Lanka then, this policy decision was made to save US$400 million that have been used by Sri Lanka to import synthetic fertilisers and to safeguard the national sustainable food systems and farmer's health (Torrella, 2022). This policy decision induced scarcity, then a price hike in fertilisers, pesticides, herbicides and other essential agrochemicals. It led to farmer protests around the country, demanding access to fertilisers and other agrochemicals (Samaraweera, 2021). In addition, experts painted an alarming picture of the impact the policy would have on future food security in Sri Lanka (Farzan, 2021) .

By mid-2022, Sri Lanka was experiencing unprecedented high inflation due partly to supply chain disruptions and high fertiliser prices (Central Bank Sri Lanka, 2021). Food prices increased at a record-breaking rate of 91% in the month of July, from an 80% increase in June 2022 (Department of Census and Statistics, 2022a). Since mid-2022, Sri Lanka has had a foreign currency deficit, severely affecting imports of essential items such as fuel and medicine (Macan-Markar, 2022; Perera, 2022). People were in fuel queues for days, even weeks, to access limited stocks (Sharma et al., 2022).

In September 2021, the Sri Lankan Government started distributing imported nano-nitrogen fertilisers to fulfill the fertiliser requirements of farmers. However, it did not provide a lasting solution for the farmers due to issues related to the fertilisers' effectiveness, availability and price. Significant farmer opposition resulted, and the agrochemical import ban was reversed with effect from November 30, 2021 allowing the importation of chemical fertilisers and pesticides for agricultural activities to resume (Economy Next, 2021; Weerahewa & Dayananda, 2023).

Due to the fuel scarcity, fuel prices increased on December 20, 2021. This impacted the movement of vegetables to the markets and there were warnings of possible limited vegetable supplies in early 2022. Although the fertiliser import ban had been lifted, it took time for fertilisers to reach local

markets and further time to be transformed into harvested vegetables. By March 2022, the fertiliser shortage was severe in many parts of Sri Lanka and farmers started to protest again (Klem & Samararatne, 2022). The fertiliser shortage, high food prices and the high cost of living triggered nation-wide anti-government protests in mid-March 2022. Further, by the end of March 2022, many restaurants and cafes, who were some of the main buyers of vegetables, were closed due to household gas shortages (Rathnayake et al., 2022). Intense social protests led the government to impose another curfew on April 2, 2022 and Dedicated Economic Centres were closed again. Finally, the continuous public protests led to the resignation of the Prime Minister and the President of Sri Lanka in May and July 2022, respectively (Jayawardena, 2022).

In conjunction with the COVID-19 related shocks, other shocks continued to challenge farm households such as extreme weather events (Gunathilaka & Samarakoon, 2022). This study explores the impact of these shocks on farm households and their responses to it.

Farm households were operating linked to different stakeholders such as input suppliers, vegetable traders, policy makers and consumers. Overall, during this period, farm households were in a powerless situation because of the government policy on agrochemical imports, the authoritative power vested upon the middleman to dictate the prices and the lack of monitoring of input prices during this period. Even though farmer collectives such as farmer organisations existed, they were also not in a position to express collective resistance to the malpractices taking place at the grass root level.

4.3.3 Government responses during the pandemic related to agriculture

The responses of the Government of Sri Lanka to COVID-19 mainly focused on minimising the disease spread and maintaining socio-economic activity while safeguarding the health of the community. The pandemic responses specifically linked to food supply were associated with price controls, declaring agriculture an essential service, home gardening, amendments to food import regulations, and safety

nets (Weerahewa et al., 2022). These measures directly and indirectly influenced vegetable farm households. Some of the government responses were related to the government policies implemented before the pandemic. The government banned the imports of turmeric and few other minor export crops such as pepper, areca-nut, and tamarind in December 2019 to boost the local production by small-scale farmers (Newsfirst, 2019). Consequently the import ban of turmeric , which is an essential spice in daily Sri Lankan cuisines, increased its prices at the local market by 275% (from Rs. 80 to Rs. 3,00 per 1 kg) (Wijesinghe, 2021). There were farm households involved in this study who had been cultivating turmeric before this ban and they tried to get the advantage of this price hike by intensifying on turmeric cultivation. However, in March-April 2020, to control the market prices of foods, the government set a maximum retail price for essential foods which included rice, lentils, fish and also turmeric (Weerahewa et al., 2022).

Farm households were benefited when agriculture was declared an essential service, because they were able to continue field activities. Government supportive mechanisms for farm households during the pandemic were mainly associated with input supply and markets. The DoA distributed seeds among farm households by mobile vehicles during the travel restrictions and later they provided a seed subsidy to eligible farmers through a special seed subsidy programme called *saubhagya* (prosperity) programme. The beneficiaries of this programme were selected based on the land area cultivated with vegetables (interview with DoA official). There was also a '*saubhagya*' homegardening programme initiated by the DAD and it provided seeds and seedlings to about 2 million households during this period (Weerahewa et al., 2022). Fertiliser distribution was carried out by DADs with the support of farmer organisation members. At the beginning of lockdown, since farmers could not travel, officers of the DAD personally brought seeds and agrochemicals from private sector input stores in distant places and sold them among farm households. These officers continued this support even later when farm households could not access inputs.

Conventional marketing channels of vegetables were not properly functioning during the pandemic. Therefore, the government introduced a vegetable purchasing system operated through DS offices. It was decided to purchase vegetables directly from the farmers and sell them to Dedicated Economic Centres (Ministry of Agriculture and Plantation Industries, 2020). By April 2020, the government purchased about 904 MT of vegetables through this programme (economynext, 2020). When the markets were re-opened, but the travel restrictions existed, a travel permit was issued to transport vegetables (and other agro-products) to markets.

At the onset of the pandemic, the extension services from DoA or DAD were not functioning as usual. However, later some officers from DoA and DAD continued their duties amidst restrictions during the COVID-19 period. This included trainings and awareness programmes related to organic agriculture which was accelerated after the agrochemical import ban policy.

Additionally, the government controlled the imports of foods and essentials to reserve the foreign exchange during the pandemic (Weerahewa et al., 2022) and introduced some safety net programmes to support household income. The government provided a monthly cash allowance of Rs 5,000 to needy households during the first and second waves of COVID-19, benefiting around four million vulnerable households including senior citizens, people with disabilities, kidney patients, and *Samurdhi* recipients (Thibbotuwawa, 2020; worldbank, 2021). Government officers, such as DS officers, *Grama Niladhari* officers, *Samurdhi* officers, and Development officers,[22] were involved with identifying the beneficiaries for this programme and dispatching the benefits.

[22] An officer belonged to the Ministry of Public Administration, Home Affairs, Provincial Councils and local government

4.4 Conclusion

This chapter explained the study area and research context. This study was conducted in Nuwaraeliya and Kandy districts in the Central Province of Sri Lanka. Farm households in Nuwaraeliya and Kandy districts cultivated upcountry and low-country vegetables depending on the agroecological conditions in the region. Upcountry vegetables are cultivated on lands with high elevation in the Nuwaraeliya district, whereas low county vegetables are produced in low lands in both districts. Vegetable production in the Kandy district is carried out mainly as a rice-based cropping system. The scale of vegetable production varied across farm households in Kandy and Nuwaraeliya districts. Marketing of vegetables involves different stakeholders, including middlemen, supermarkets, hotels and restaurants, and retail markets. Both government and private sector influence the input supply for vegetable production, vegetable markets, and providing extension services.

This study was conducted when COVID-19 was in progress. In April 2019, the Easter bomb attack affected the tourism sector in Sri Lanka, and the negative effect on tourism worsened with the COVID-19 restrictions put in place in a later period. The first case of COVID -19 in Sri Lanka was reported in January 2020, and since then, a variety of COVID-19 restrictions have been imposed in Sri Lanka. Three distinct waves of the COVID-19 were experienced in Sri Lanka. During the third wave, a new government policy on the agrochemical import ban was imposed which were later transformed into an economic crisis. The country's economic crisis in the latter part of the pandemic period resulted in different economic, social and political issues in Sri Lankan society. In this context, data were collected from vegetable farm households in Nuwaraeliya and Kandy districts to explore how they were impacted by these shocks, how they responded to them and why they responded in the way they did. The findings will be presented in the next chapter.

5) RESULTS

5.1 Introduction

The Results chapter presents the impacts of different shocks on Sri Lankan vegetable farm households during the COVID-19 pandemic, their coping strategies, and the factors that influenced these strategies, as highlighted in the previous chapter. This study involved two sites in the Central Province: Kandy and Nuwaraeliya. The data collection commenced in Kandy district during December 2021, about one month after the agrochemical import ban policy was lifted. There were input shortages and community protests around the country, and there was no COVID-19-related lockdown in effect at the time of data collection in Kandy. In contrast, the data collection in Nuwaraeliya district was started in February 2022, and the pre-existing socio-economic crisis in the country had escalated during this period with worsened input and fuel shortages, power cuts, high cost of living, and depreciation of the local currency, rupee (Rs.). Farm households in both districts had experienced the impacts of COVID-19 mitigation measures. Overall, despite the difference in timing in data collection, the impacts of shocks on the farm households in Kandy and Nuwaraeliya over time were reasonably similar.

The results in this section are strongly drawn from correspondence with farmers and key informants and will include quotes. The confidentiality of the farmers was ensured by using English characters (e.g., Mr A and Mr B) to distinguish them. In contrast, the confidentiality of the key informants was ensured by using only their position and affiliation (e.g. Department of Agriculture official) at the end of their quotes.

This chapter consists of six sub-sections. The second subsection will answer the first research question by describing the impacts of shocks that farm households experienced during this period. Then, it will address the second research question by describing farm household strategies to respond to the impacts. The fourth subsection will show the positive impacts on farm households during this period followed by one on the broad scale impacts and possible future implications. The chapter will conclude with a summary of key findings in the sixth subsection.

5.2 Impacts on farm households

During the COVID-19 pandemic, farm households experienced impacts of multiple shocks, including COVID-19. COVID-19 affected people's health, with some farm households directly affected by the infection: there was one death from COVID-19 and a few instances of COVID-19 quarantine. During the COVID-19 pandemic, the mitigation measures implemented by the government impacted the community and, undoubtedly, influenced the well-being of farm households. The specific impacts of the COVID-19 pandemic on vegetable farm households, which was the scope of this study, were associated with vegetable production and marketing. Therefore, the following section will present the impacts of shocks specific to vegetable farm households.

The ultimate result of the shocks during this period on farm households was financial. This impact was associated with decreased income and increased costs. All farm households across two case sites experienced this financial impact at different levels. One farmer (Mr A) explained his experience:

Mr A was a farmer in the Kandy district who cultivated 0.4ha of land with capsicum and green chillies.

'*In the past, I received an income of about Rs. 5 to 6 laks [Rs 500,000 to 600,000] per season. But now it is Rs.2 to 3 laks [Rs. 200,000 to 300,000] per season'* (quote from Mr A in Kandy).

Given the reasons associated with the financial impact which will be presented in the following sections, Mr A's income loss was unique to him and different from that of other farmers.

The financial impact on farm households resulting from increased costs and decreased income was due to four main reasons: i) increased cost of production, ii) decreased production, iii) loss of markets and iv) increased household costs. Figure 5.1 shows the reasons which caused financial impact on households during this period.

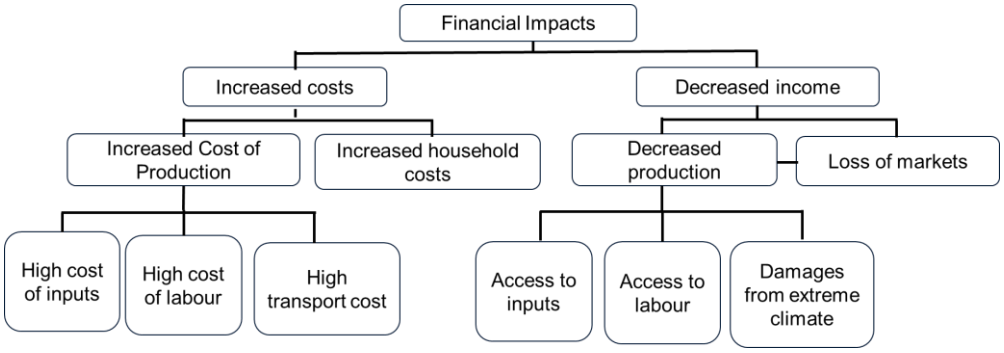

Figure 5-1.Reasons for the financial impact on households during the pandemic

There were also household well-being impacts due to four main reasons: i) disrupted social life, ii) disrupted non-farm income sources, iii) difficulties in accessing services including health and education, and iv) loss of access to livelihood essentials. These reasons for financial impact and household well-being impact will be explained in the following sub-sections.

5.2.1 Increased cost of production

The increased cost of production, due to the higher cost of inputs, labour, and transport was one of the main reasons for the financial impact on farm households.

High cost of inputs

All farm households used hybrid seeds, synthetic fertilisers and other agrochemicals such as pesticides and herbicides, and they purchased these inputs from both public and private sector suppliers. Many of these products were imported and their supply chain was disrupted during the COVID-19 pandemic because of the national and international travel and shipping restrictions. As a result, input prices more than doubled during this period compared to pre-pandemic levels.

Mr B, a farmer in Nuwaraeliya who cultivated broccoli, carrots and potatoes on 0.6 ha of land explained his experience which was common to all farm households who experienced high fertiliser prices.

'*The price of a 50kg urea pack was about Rs.1,300 in the past, and now it is Rs.24,000. After the fertiliser ban, one lorry load of cattle manure is about Rs. 35,000. It was about Rs.17,000-18,000 before the COVID-19. One load is only adequate to apply for 0.1 ha. When we apply manure to the field, it costs above Rs. 60,000 with the labour cost, and I need six such loads of cattle manure'* (quote from Mr B in Nuwaraeliya).

The high cost of seeds was also commonly evident, as explained by Mr C, a farmer in Nuwaraeliya who cultivated carrots and leeks on 0.8 ha of land.

'*The price of 400 g of carrot seeds was Rs. 3,000 in the past. But now it is Rs. 6,500-7,000. I usually need 1.5 kilos of seeds. It's a big cost now. One kilo of Mancosap (a fungicide) was Rs.1,200 in the past, and now it is Rs. 4,500-5,000, and we can't find Mancosap here even for Rs. 4,500-5,000'* (quote from Mr C in Nuwaraeliya).

Participants reported that some private sector input suppliers earned extraordinary income by selling products on the black market. The input suppliers also did not receive adequate stocks to sell because of disruptions in the supply chain. Therefore, they sold the available inputs at very high prices and this was common in both districts. Mr D a farmer in Nuwaraeliya who cultivated 0.4 ha of land with potatoes, leeks, carrots, and cabbage explained this situation as follows:

'*Store owners hid the inputs. Because of COVID-19, no input came from overseas. Then, we had to pay a threefold price for pesticides. Sometimes, there were low-quality products from the black market at very high prices. Ground chickpeas were sold pretending it's Polyrom [a fungicide]. We were being cheated by traders like that'* (quote from Mr D in Nuwaraeliya).

Before the lockdown, input suppliers sold inputs at a discounted price, and farm households could purchase these products at a price 30% lower than the manufacturer's labelled price. However, once the inputs became scarce during the pandemic, they were only sold at the manufacturer's labelled price, which was higher than the pre-COVID market price.

The price of available stocks of chemical inputs was further increased after the agrochemical import ban was introduced. This resulted in high demand not only for chemical inputs but also for organic, locally sourced inputs, significantly inflating their price. For example, the following quote from a farmer indicates the price change of locally available cattle manure. '*We bought cattle manure when we could not find chemical fertilisers. Before COVID-19, 100 buckets of cattle manure was about Rs. 12,000. It was about Rs. 18,000 immediately after COVID-19, and after the fertiliser ban, it became Rs. 35,000*' (quote from Mr D).

Similarly, locally available seed varieties became expensive because of the scarcity of imported hybrid seed varieties. For example, farm households in Nuwaraeliya that cultivated potatoes had to spend more on local seeds than they did during the pre-pandemic times, as shown in the following quote:

'*Local seed potatoes were Rs.10,000- 12,000 per kilo. Now it is Rs.15,000-18,000*' (quote from Mr C).

During the pandemic, there were no consistent prices across input stores, resulting in products being sold at very high prices, sometimes exceeding the manufacturer's labelled price. Many of the agrochemicals used in Sri Lanka were either imported in bulk for repackaging or as concentrates. However, the private sector mainly set agrochemical prices even before the pandemic. Many farm households claimed that the lack of government intervention in closely controlling the input prices during and after the pandemic left a vacuum resulting in private input suppliers setting inflated input prices. This was raised by all the farmer households interviewed in this study. A farmer from a farmer group discussion in Kandy highlighted this as follows:

'*No one is coming to inspect the input prices. Traders sell at whatever price they wish, and we had to buy anyhow as we don't have any other option'* (quote from farmer group discussion in Kandy).

High cost of labour

High labour costs also contributed to the cost of production. All the farm households interviewed used hired labourers in vegetable farming, but the scale and time of using hired labourers varied. The labour cost gradually increased mainly because of the escalating cost of living. On the one hand, the direct labour wages increased; on the other hand, farm households' expenses for food and refreshments provided for the labourers (e.g., tea, snacks, betel leaves) also increased. High labour costs particularly impacted farm households who cultivated relatively larger land areas and used hired labourers more frequently compared to farm households who cultivated smaller areas of land areas and used fewer hired labourers. The change in the labour cost slightly varied among farm households in both districts. The following quote from a farmer illustrates an example of high labour cost: *'Now I am paying about Rs. 2,000 to 2,200 per day per person, with food. It was about Rs.1,500 before COVID-19*' (quote from Mr D).

Increased labour costs were sometimes related to input scarcity. Some farm households applied compost to their fields when they could not find chemical fertilisers, a much more labour-intensive activity. According to a farmer in Kandy (Mr E), applying compost increased labour costs. Mr E cultivated 0.7 ha of land with various vegetables. His cultivated land was not flat. He employed a labourer from his village to prepare compost and apply it to his field. He explained his experience as follows:

'I used to pay Rs.1,700, but now I have to pay him about Rs.2,500. Because he is doing heavy work moving up and down in this land carrying manure bag on his shoulders and he is a known person to me as well' (quote from Mr E in Kandy).

This quote also shows the difference between changes in labour cost compared to the quote from Mr D illustrated above.

The lack of effectiveness of available inputs also affected labour costs. For example, when the available herbicides were ineffective, farm households sometimes had to do manual weeding using hired labour, which further increased their cost of production.

High transport cost

Many farm households used hired transport to deliver inputs to the farm and to convey the harvest to the markets. The transport cost for farm households increased because of the higher fuel costs during this period. Farm households who lived far from the main road or city and produced on a comparatively larger scale were more impacted than those who lived near the city, produced on a smaller scale and used fewer inputs. This was evident among a few farm households in both Nuwaraeliya and Kandy districts. One such farmer in Nuwaraeliya district explained his experience:

Mr F was a farmer in Kandapola, Nuwaraeliya, and cultivated 0.8 ha of land with cabbages and potatoes.

'I have to go about 8 km from the town of Kandapola, so I have to use a lorry [truck] or a three-wheeler for transport. A three-wheel hire was about Rs.300-350; for a small lorry, it was about Rs. 1,200-1,500. Now, a three-wheeler hire is about Rs. 700- 800, and the lorry hire is above Rs. 2,500' (quote from Mr F in Nuwaraeliya).

When there was a fuel shortage, some farm households had difficulty accessing fuel for their water pumps or weeding machines.

5.2.2 Decreased production

Decreased production of vegetables also had a negative financial impact on farm households by reducing farm income. Production was decreased in quantity, a reduced harvest volume and quality (e.g., the pod size of bitter gourd) of the harvest obtained (Figure 5.2). Moreover, low input use and damage from extreme weather also reduced the yield and quality of vegetables produced by about half of the farm households across two districts. The following quote illustrates the experience of one such farmer in the Kandy district.

Mr G was a Kandy farmer who cultivated vegetables on 0.2ha of land.

'On other days, I usually harvest about 400-500 kilos of bitter gourd per season. But it is only about 15 kilograms this time' (quote from Mr G in Kandy).

Sometimes, decreased vegetable production was linked to the increased cost of production and availability of inputs. Some farm households could not source inputs adequately and employ hired labour, resulting in lower production.

Access to inputs

Many farm households could not access inputs during the lockdown period. This was because of the closure of input stores, farm household's inability to travel to purchase inputs, and the lack of availability of inputs in input stores. Conversely, a few comparatively small-scale farm households in the Kandy district used a limited amount of chemical inputs, so were minimally impacted.

Although input stores were closed at the onset of the pandemic in 2020, they were later allowed to open for a stipulated period, but with limited inputs available for sale. An officer from the DAD explained the situation as follows:

'In *August-October 2021, there were no fertilisers in the market. Fertilisers were available only in Agrarian Service Sales Centre'* (quote from an officer from the Department of Agrarian Development).

The data from Kandy farm households suggested that farm households experiencing a long-term relationship with input suppliers could purchase available inputs whenever the input stores were opened, compared to other farm households who did not have such a relationship. Interviewees claimed this was more prevalent amongst private sector input suppliers.

One farmer in the farmer group discussion in Kandy shared his experience as follows:

'*Sometimes, when I ask for tomato seeds, they did not give them to me. But when my friend asked, he can buy seeds. If I am a regular customer, they will issue inputs quickly; otherwise, there is no way'* (quote from a participant in farmer group discussion in Kandy).

According to some officers from the DAD, input supply from Agrarian Service Sales Centres was fairer than from private input suppliers. Many farm households could not travel to input stores because of travel restrictions during the pandemic. During the lockdown period, people could not travel without a travel permit. Some input suppliers in Kandy obtained a travel permit and distributed the inputs to the villages. However, farm households who purchased inputs from other areas at lower prices were not interested in buying from these mobile input suppliers at higher prices.

When the input scarcity was severe, farm households had to order fertiliser in advance and wait for fertilisers to arrive. This sometimes resulted in delays in the production process namely crops were not planted on time.

Being a government input supplier, there was also variability between the Agrarian Service Centres. There were no active Agrarian Service Centres in some areas (e.g. Hawaeliya) in Nuwaraeliya; therefore, farm households could not access government-provided inputs. Some of the Kandy farm households also noted that favouritism occurred during the distribution of limited stocks of fertilisers through Agrarian Service Centres, which meant family members, relatives, and people who had a good relationship with officers from the DAD could purchase the fertilisers. Sometimes, Agrarian Service Centres did not have what farm households required.

Usually, the Agrarian Service Centre purchased inputs from large-scale private sector suppliers, sometimes for credit. However, later, the Agrarian Service Centre could not borrow input from private sector suppliers as they were also in a financial crisis that continued from the onset of the pandemic. The following quote from an officer from the Agrarian Service Sales Centre illustrates the changes in the government's procurement of inputs from the private sector.

'*Some chemicals such as fungicides are not available here. However, we tried to purchase the essential chemicals for farmers. But we don't maintain a big stock here as in the past. Because now we must buy everything in cash. But in the past, we borrowed a huge stock and made the cheque payment late*r' (quote from officer-in-charge of Agrarian Service Sales Centre).

Even though some farm households had access to inputs, sometimes the quality of the inputs was low. Input store owners sold leftover stock at high prices because the supply chain breakdown meant they had no fresh inputs. About half of the farm households highlighted the low quality of inputs, and the following quote from Mrs H is an example of a farmer's experience.

Mrs H was a vegetable farmer in Doragla, Kandy district. On about 0.2 ha, she cultivated beans, okra, and brinjal.

'*I had to plant beans for the second time. The seeds I planted earlier did not germinate; those seeds might be expired seeds*' (quote from Mrs H in Kandy).

After the government policy banning agrochemical imports, accessing inputs became more difficult for all farm households. The input scarcity initiated by the pandemic, increased after the policy. According to some farm households, input store owners issued pesticides and herbicides only to large-scale farm households, not to relatively small-scale farm households as illustrated by the following quote.

Mr I was a farmer in Nuwaraeliya who cultivated leeks and carrots on 0.3 ha of land.

'There is a minimal amount of pesticides in the market now. No fungicides at all. Even if available, they were given only to large-scale farmers, not us (quote from Mr I in Nuwaraeliya).

a) Damage to long beans due to lack of fungicides

b) Damage to tomatoes due to lack of fertilisers, fungicides and pesticides

Figure 5-2.Illustration of crop losses (Source: Author)

In the past, farm households received locally produced seed potatoes from government farms at a lesser price than imported seed potatoes. However, supply from the government farms was reduced during this period. One farmer organisation leader experiencing good relationships with agricultural officers could acquire local seed potatoes from government farms as illustrated in his following quote.

'*We received G 0 [Generation 0 seed potatoes]* [23] *under the 50% contribution programme. But we did not receive that subsidy this year. Since I am the farmer organisation president, I got at least 2 to 3 boxes of seed potatoes for our members'* (quote from Mr C).

Interestingly, later, farm households were not interested in purchasing even local seed potatoes as they could not access other inputs (e.g. fertilisers, pesticides, herbicides) to cultivate potatoes.

The government policy banning agrochemical imports influenced the prices of chemical and non-chemical inputs. Some input suppliers could not provide inputs even to their long-term customers, as explained by the following quote from a farmer in Kandy.

Mrs J was a farmer in Kandy who cultivated 0.6 ha of land with cabbages, carrots, beans, and capsicum. She also had a tea and poultry manure-selling business. Mrs J used to sell poultry manure which she purchased from poultry manure suppliers in a distant area. The demand for poultry manure increased drastically after the agrochemical import ban policy because many farm households started using poultry manure to prepare compost. However, input suppliers provided poultry manure only to large-scale farm households.

'*We could not purchase poultry manure from where we had bought poultry manure for almost 20 years!*' (quote from Mrs J in Kandy).

[23] Seed potato production begins with mini tubers and then by producing Generation 0 (G0)

Input scarcity did not disappear even after the government's agrochemical import ban policy was reversed and farm households struggled to source inputs. There was no stock in the Agrarian Service Centre, as confirmed by an officer from the Agrarian Service Centre in the following quote, and only private sector input suppliers sold inputs at very high prices.

'We *used to borrow inputs from a large-scale private sector input supplier in Dambulla. Now we can't borrow from anywhere. Unlike in the past, transactions are possible only in cash. Our input supplier does not have inputs, and they are about to cease its operations'* (quote from the officer in charge of the Agrarian Service Sales Centre).

Farm households who had available finances bought inputs even at high prices. Consequently, their production was not significantly impacted compared to others who could not afford expensive inputs and labour. However, this changed over time. These farm households started to experience production loss when the input shortage worsened. Farm households' ability to purchase scarce inputs, and the options available for farm households for inputs were reduced over time. Lack of access to inputs was a sensitive issue for the farm households across two case sites, as many farm households highlighted their crops were destroyed (Figure 5.2, Figure 5.3) and farm households were helpless without farm inputs. One farmer shared his view as follows:

Mr K was a vegetable farmer in Doragala, Kandy. He cultivated 0.5 ha of land with cabbages and capsicum and 2.8 ha of land with tea.

'*It is fair to increase the prices of essentials. But we need to have fertilisers and pesticides, nothing else. So that we can earn to afford expensive essentials'* (quote from Mr K in Kandy).

Figure 5-3.Damage to Maize crop due to a lack of pesticides (Source: Author)

Access to labour

Many farm households had difficulties accessing labour, first due to COVID-19 mitigation measures and second, due to high wages and the high cost of living.

Access to labour during the lockdown was difficult for many farm households, as the hired labourers could not travel. The data from the Kandy district showed that even when the lockdown and travel restrictions were lifted, labourers did not come to work. Sometimes it was due to the fear of getting the virus and other times because farm household members or neighbours were under quarantine. An exception to this was urban farm households in Nuwaraeliya who had access to a 'labour market'. Because of the year-round vegetable cultivation in the Nuwaraeliya district, there was a high demand for labour in the vegetable fields. To meet this demand, there were places in Nuwaraeliya city and adjacent cities where labourers assembled each morning and farm households could visit these places to pick the required amount of labour. When the lockdown was lifted, this process continued. Therefore, compared to other farm households in both districts, urban farm households in

Nuwaraeliya did not have the same difficulties finding labour in the post-lockdown period as illustrated in the following quote.

'*We don't have to wander searching for labourers. People who do field work such as land preparation and weeding arrive in Kandapola town at about 7 a.m. There is one such gathering place in the city. We used to go there and take them to our fields'* (quote from Mr I).

Pre-pandemic, some residents of Nuwaraeliya worked in distant urban areas but returned to Nuwaraeliya because of business closures and the spread of COVID-19 in those urban areas. This increased the labour supply in Nuwaraeliya during the travel restrictions period. This is illustrated in the following quote from Mr L.

Mr L was a farmer in Nuwaraeliya who cultivated vegetables on 0.6ha of land.

'*There were many labourers here during the COVID-19 period. Many people from Nuwaraeliya worked in distant areas like Colombo, Galle, and Matara. Because of business closure, they lost their jobs. They were afraid to stay in those cities because of the spread of the virus. Therefore, they returned to Nuwaraeliya and worked in vegetable fields here'* (quote from Mr L in Nuwaraeliya).

Few farm household members who did off-farm work could not travel to work, so they were able to spend time on farm work, reducing external labour requirements. One farmer (Mr I) who also worked as a three-wheel driver, could not travel because of the travel restrictions and he shared his experience as follows:

'*We did not have any labour problem. We didn't have anything to do. We were always on the farm those days and did our work by ourselves*' (quote from Mr I).

Damages from extreme climate

About a half of farm households also experienced production loss due to damage from extreme climatic events during this period. Heavy rains negatively affected farm production, with crops rotting or whole crops destroyed as illustrated by the following quotes from affected farmers.

'I had potatoes in about 0.2 ha of land. It was completely damaged because the heavy rains fell after August 2021' (quote from Mr I).

Mr M was a farmer in Kandy who cultivated 0.4 ha of land with local yams, cassava, and long beans.

'*I could not get a good yield from manioc (cassava). We got continuous heavy rains for about six months, and manioc got rotten inside, so we didn't have manioc left to uproot'* (quote from Mr M in Kandy).

The lack of rain at different times affected a few farm households in Kandy.

Mr N was a vegetable farmer in Kandy who cultivated vegetables in about 0.1 ha. He also worked as a carpenter to diversify his farm income.

'*I planted beans and brinjal, and they did not succeed because of lack of rain. When it grew a bit, the bean vines died because they did not receive enough rain'* (quote from Mr N in Kandy).

The extreme climate affected vegetables and other crops from which farm households drew a considerable income. This was particularly high for farm households in Nuwaraeliya who cultivated pepper, and one farmer (Mr O) shared his experience. Mr O was a farmer in Nuwaraeliya who cultivated vegetables on about 0.1 ha, pepper on 0.1 ha, and paddy on 0.3 ha.

'*In the past, I sold pepper worth about Rs.150,000 from 0.1 ha. This time, I could not get even Rs.25,000 from pepper. There is no pepper yield this time at all. This is the third consecutive year without a good pepper yield. Pepper was one of our main income sources, and we completely lost it'* (quote from Mr O in Nuwaraeliya).

5.2.3 Loss of markets

The loss of markets directly resulted in a negative financial impact on farm households through low vegetable income. Many farm households lost market access to vegetables at different levels,

irrespective of the types of vegetable markets to which vegetables were sold. At first, markets were lost due to travel restrictions, COVID-19 lockdowns and fuel scarcity. These reasons led to the intermittent closure of vegetable marketing avenues (e.g., retail stores, Dedicated Economic Centres, fairs, hotels, and restaurants), as well as a lack of movement of vegetable collectors to the farm, and difficulties for farm households to travel to markets. When the markets were closed, farm households who cultivated relatively large amounts of land and harvested vegetables in bulk were more negatively impacted than others who could implement alternative marketing strategies.

An exception was the comparatively large-scale farm households in Nuwaraeliya involved in both input supply and selling their vegetables. Some large-scale farm households who lost their income due to market closure tried to compensate for the financial loss by selling inputs at high prices. However, small-scale farm households that entirely depended on vegetable sales and had no alternative income source were impacted heavily by market closure.

Three farm households who transported vegetables to the markets had to transport them back to their farms because of a lack of sales. The failure to sell was linked to lower demand due to high vegetable prices but also a lower quality of produce. One farmer (Mr P) shared his experience:

Mr P was a vegetable farmer in Nuwaraeliya who cultivated cabbages, beans and tomatoes. He also served as an officer attached to the DAD.

'*We should harvest tomatoes once per 3 days. But I had to do it once per week. Markets were opened once every four to five days. I transported 200 boxes of tomatoes to the Dambulla Dedicated Economic Centre, and they did not purchase them as they were over-ripened. Then I returned that bulk to home and discarded them*' (quote from Mr P).

Some crops were more sensitive to time of harvest than others, as confirmed by an officer from the Dedicated Economic Centre in Nuwaraeliya.

'*It does not matter if we harvest some vegetables such as carrots, beetroot, leeks, cabbages, and radish even after one week. However, vegetables such as beans, tomatoes, luffa, and long beans should be harvested within three days. Otherwise, they will become overgrown. If it is overgrown, it is impossible to sell*' (quote from Dedicated Economic Centre official).

However, when the market closure lasted an unexpectedly long period, even vegetables with relatively low perishability were wasted.

'*Normally, the weight of a carrot is about 300 g to 500 g, but it became about 1 kg as farmers did not harvest them during the lockdown. Chillies burst and wasted. Leeks became yellow colour and wasted*' (quote from Dedicated Economic Centre official).

The way the market operated during this period negatively affected farm households. For example, the Dedicated Economic Centres were open only for a few days and with little notice. When the markets were opened, the vegetable supply was extremely high, leading to a price drop.

Urban farm households in Nuwaraeliya who cultivated specific types of vegetables for niche markets, were highly impacted by market closure compared to other farm households. These urban farm households grew certain vegetables like, broccoli, herbs, spices, and Chinese cabbage, which needed to be harvested on time to maintain quality. This produce was then sold solely to hotels and restaurants in the tourism sector. Hotel and restaurant closures due to fuel scarcity and travel bans led to the market loss in the tourism sector for these specific types of vegetables. Furthermore, locals did not commonly consume vegetables such as broccoli, herbs, and spices which meant that an alternative marketing strategy amongst locals was not available to these urban farm households. As illustrated in the following quote, farm households that grew vegetables such as carrots and leeks were also affected because hotels and restaurants were their primary market.

'*There is a high demand for leeks and carrots from hotels and restaurants because those vegetables are needed to make fried rice. But, because of lack of household gas, about 4,000 to 5,000 hotels in the country have closed now and no vegetable orders today at all'* (quote from Mr C).

One farm household in Kandy cultivated crops targeting religious events. During full moon days (*poya* days), some people, mostly Buddhists, provided free food for others, believing it would bring good fortune. This is called '*Dansal*' in the local language, which means 'giving free'. During full moon days, it was expected to see people waiting in *Dansal* queues to obtain free food. One farm household cultivated cassava to sell to *Dansal* organisers. However, because of the social distancing measures during the pandemic, all social activities were banned, including holding *Dansals*. As a result, the demand for those crops was reduced. This farmer shared his experience as follows:

'*Those days, there were many Dansal here. When people have free time, they hold Dansal, which needs thousands of manioc. But this time, no Dansal, nothing. I boiled some manioc and distributed it among people working in the temple. At least I will receive some good fortune*' (quote from Mr M).

Export market access was also lost. Subsequently, farm households in Kandy who cultivated crops for this market had to sell the produce to locals at very low prices, as shown in the following quote.

'*Exporting vegetables was stopped. Some farmers cultivated chillies in tunnels and could not sell them to the export market. Then, they had to sell those at a very low price of Rs.40 per kilo. Usually, they received about Rs.200 per kilo'* (quote from an Agricultural Instructor from the Department of Agriculture).

Many farm households traditionally sold vegetables to middlemen, of which there were different types. Sometimes, middlemen were from large-scale farm households in the area, while sometimes, middlemen were traders from Dedicated Economic Centres. Farm households received slightly different vegetable prices from different middlemen, and during the pre-pandemic period, farm households could choose from the most profitable marketing methods. However, during the lockdown period and concurrent travel restrictions, there was a lack of middlemen, which reduced market access

for farm households. Therefore, farm households could not choose the most profitable marketing method as they did in the past; instead, they had to sell to whichever middlemen were available.

Sometimes, middlemen did not come to the farmers' fields, therefore farm households had to transport the produce to the middleman. In such instances, physical distance from markets or the main road negatively affected some farm households to access middlemen. During the pandemic period, middlemen came only to the central city, and farm households had to transport the vegetables to the city. It was challenging and costly to go to the city during travel restrictions, especially for those farm households who lived more remotely.

'*It was difficult to sell those days. Traders came only to Kandapola town. But we live about 10 km from Kandapola town'* (quote from Mr C).

Due to travel restrictions, farm households who usually transported vegetables to distant markets could not do so.

The influence of fuel scarcity on market access was more evident among Nuwaraeliya farm households than those in Kandy because of the difference in the timing of data collection and the context in which farm households were operating at that time. The following quote illustrates the situation farm households experienced due to lack of fuel.

'*It is hard to sell vegetables because of the lack of diesel and household gas. Middlemen are not coming as they don't have diesel. Hotels are closed as they don't have household gas'* (quote from Mr C in Nuwaraeliya).

Loss of markets was also linked to loss of production in terms of reduced harvested crops. Farm households whose production was lost due to lack of input or climatic damage did not have enough to sell. Loss of markets resulted in vegetable waste in farmer's fields or vegetable markets as confirmed by an officer from a main vegetable market in Nuwaraeliya.

'*We could not sell even 25,000 kg of vegetables daily from Dedicated Economic Centre Nuwaraeliya because of lack of demand during the lockdown. There was about a 25 to 50% waste of vegetables at the DEC Nuwaraeliya during that period. In other areas, it might be about 75%*' (quote from Dedicated Economic Centre official Nuwaraeliya).

Meanwhile, the price of vegetables in the market fluctuated continuously with unfavourable outcomes for farm households. Some farm households in Kandy could access the middleman during lockdown, but the prices they received were very low. According to many Kandy farm households, middlemen earned a good profit marketing vegetables during the lockdown period, but the profits did not reach the farm households. When the vegetable prices dropped, and the cost of vegetable production increased, farm households were financially affected and their profits were low. One farmer (Mr D) shared his experience as follows:

'*We spent about 12 laks [Rs.1,200,000] for fertilisers, and when we sold vegetables at low prices, we faced many problems. We could not pay the loans, and everything got stuck'* (quote from Mr D).

The government initiated a vegetable purchasing programme during this period. However, the traders introduced to the farm households through this programme were the normal middlemen in the village with whom farm households already had contacts with. Therefore, as indicated by few farm households, introducing a new vegetable purchasing programme did not make a big difference. The following quote from a farmer who also served as an officer in the DAD explained this situation.

'*In the 2020 yala season, the same types of traders in the village were introduced to us through the Divisional Secretariat offices. Then what happened was we had to sell vegetables at whatever the prices they asked for and very often we received a very low price*' (quote from a farmer who was a Department of Agrarian Development officer).

5.2.4 Increased household costs

There were other specific impacts on the finances of farm households during this period, unrelated to vegetable production and marketing. The cost of essentials (e.g. food, medicines, household gas) went up dramatically, as a consequence of the financial crisis in the country and a lack of imports, resulting in a negative financial impact on farm households. Another factor causing increased household costs for some urban farm households in Nuwaraeliya, was when family members returned home from other areas due to the pandemic. Some farm household members who worked in the Western Province lost their employment because of COVID-19 mitigation measures: the Western Province was one of the areas with many COVID-19 cases. Therefore, expanded Nuwaraeliya farm households, had increased their total household costs, including food, education, and travel.

Mr Q, a farmer in Nuwaraeliya, explained his experience:

'My son worked in Gampaha [in the Western Province] as a casual labourer and lost his job during COVID-19. The COVID-19 situation in Gampaha was worse than here. He could not feed the family, and finally, my son, his wife and two kids arrived here. His kids are eight years and 1.5 years old. The big child is attending a school here' (quote from Mr Q in Nuwaraeliya).

5.2.5 Household well-being impacts

There were other impacts on farmer households beyond vegetable production and marketing. Similar to the general public in Sri Lanka, all farmer households experienced various household wellbeing impacts from a series of shocks during this period. Figure 5.4 shows four reasons for household wellbeing impact on farm households during this period, which will be explained in the following section.

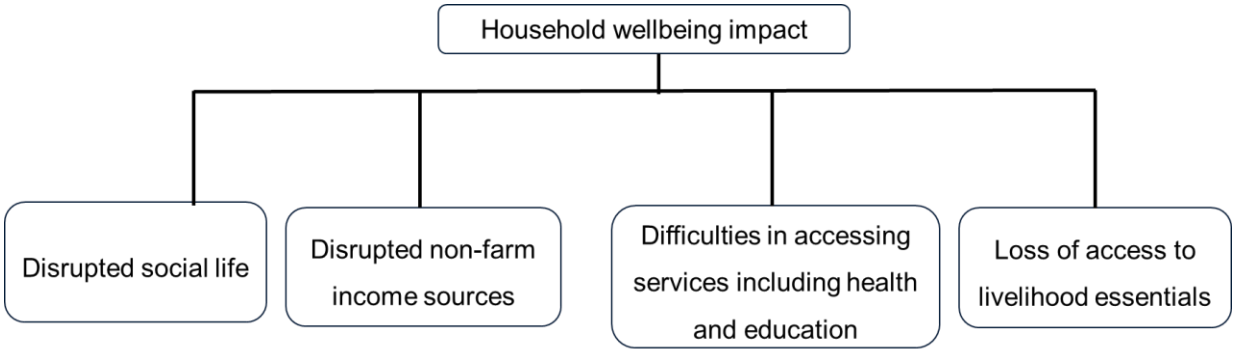

Figure 5-4.Reasons for the household wellbeing impact on households during the pandemic

5.2.5.1 Disrupted social life

Farm households could not attend their regular social activities (e.g. farmer organisation meetings) and social events (e.g. funerals, weddings) during this period. Therefore, there were low or limited face-to-face interactions with fellow farmers, agricultural officers, relatives and friends.

The national New Year in Sri Lanka also fell during this period (i.e. in April each year). During this period, people usually visit relatives, wear new clothes, prepare new foods, and hold New Year festivals. However, farm households could not conduct these New Year rituals and celebrate the New Year due to social distancing, travel restrictions, fear of getting the virus, and the high cost of living.

5.2.5.2 Disrupted non-farm income sources

In the pre-pandemic situation, about six farm household members engaged in non-farm income sources such as operating telecommunication services, providing transport services, landscaping activities, carpentry, and providing casual labour in urban areas. However, due to travel restrictions and social distancing, these activities could not be continued during this period, resulting in low household income.

5.2.5.3 Difficulties in accessing services including health and education

Farm households had difficulties in accessing basic services such as health and education. Health services were declared essential during this period. However, because of the lockdown and travel restrictions, especially in rural areas, farm households had to get permission from the *grama niladari* officers if they wanted to visit the hospitals for treatments when they were sick. This sometimes delayed the treatments.

Schools were closed, so children in these farm households could not continue their regular education activities, including national-level examinations. Due to travel restrictions, some children who lived in rural areas could not attend tuition classes in urban areas.

5.2.5.4 Loss of access to livelihood essentials

Household essentials were scarce during this period because of import restrictions, supply chain breakdown, and the severe economic crisis. The prices of essentials such as foods (e.g. milk powder), household gas, fuel, and medicines were also very high. Therefore, because of the scarcity and high prices, farm household members could not have adequate access to these livelihood essentials during this period.

Overall, the most significant impact of multiple shocks on farm households was financial. Because farm households generally had lesser incomes and the costs were higher than in the pre-pandemic period, the extent of this impact varied between farm households. The financial situation of farm households worsened with time as multiple, diverse, and unexpected shocks impacted their finances differently.

The following section will explain how farm households coped with the multiple financial impacts on them.

5.3 Coping strategies of farm households for financial impacts

Farm households developed various strategies to respond to the financial impacts they experienced during this period. These strategies were implemented to maintain their household requirements rather than to maximise profits. Farm households changed their production systems in several ways to maintain their income, or to buffer the income loss given their situation. This included changes in inputs, how often they produced crops, how many crops they had, and the types of crops they grew. Farm households also changed their vegetable marketing by changing where they got income from and how they sold their crops. The changes that farm households made in their production systems and marketing were subsequently identified as production strategies and marketing strategies.

Since farm households experienced low income and high costs in general, they also used financial hardships strategies as borrowing, reducing consumption, using savings, selling assets, receiving extension periods to repay the loans, giving up cultivation in leased lands, and relying on financial support from household members. These strategies were also meant to buffer the income loss during this period.

The following sub-sections will explain production strategies, marketing strategies and financial hardships strategies used by farm households.

5.3.1 Production strategies

Farm households changed their production systems to maintain household income and reduce costs. This included changes related to seeds and agrochemical use, cropping patterns, crop types and labour use. During the pandemic, two farm households did not cultivate vegetables at all, while others continued vegetable cultivation. Farm households who chose to cultivate had different options. They changed their production systems, as explained in the following sub-sections.

Changes in seeds and agrochemical use

Many farm households reduced the amount of inputs used in the vegetable fields while some cultivated a smaller area. Both options were to reduce the input cost. The following quote from a farmer illustrated how he adjusted fertiliser use in his field.

'*We usually apply fertilisers to this crop three times; five packs each time. But now I do not apply even one pack'* (quote from Mr Q).

Many farm households who could not access inputs because of scarcity or high cost used alternative inputs. Compost, cattle manure, and poultry manure were used as alternatives to chemical fertilisers. Many farm households used only one type of these alternatives, while few used a combination.

'*I got some compost in my field, and I have goats. So, I used compost and goat manure as fertilisers* (quote from Mr D).

The farm households with appropriate resources, time, knowledge and skills made compost in their fields, while farm households with cash in hand purchased compost or manure from the market. However, the quality of purchased compost was low, and farm households could not obtain expected crop growth and harvest using the compost alone.

When farmers could not access chemical pesticides, some farm households prepared homemade pesticides, and some used non-chemical pest control methods (e.g. covering vegetables with polythene to protect from fruit flies) (Figure 5.5). This was observed among Kandy farm households and rural farm households in Nuwaraeliya who cultivated in small areas, compared to urban farm households in Nuwaraeliya. This option of using alternatives was not available for those urban farm households in Nuwaraeliya with both comparatively large-scale vegetable production systems and lack of resources to prepare the alternatives (e.g., space, time, cows to get manure, neem to prepare organic pesticides). These urban farm households in Nuwaraeliya faced several challenges in using alternative pesticides, as shown by a quote from a farmer in an urban area in Nuwaraeliya.

Figure 5-5.Snakegourd covered with polythene (Source: Author)

'*We don't have neem in Nuwaraeliya; we have only Tea. Should we grind tea and apply it to these fields? We must find a neem forest to apply for this extent of vegetable farms here. If we use that much neem, neem will also become extinct'* (quote from Mr D).

Five Kandy farm households cultivated paddy and three of them received organic fertilisers provided by the government (but they did not use it because of lack of knowledge in the application method, high labour cost in fertiliser application, and bad smell of the organic fertilisers provided).

At the beginning of this period, using stocks of local seeds, fertilisers and other agrochemicals leftover from previous seasons was another strategy used by many farm households to respond to difficulties in accessing inputs. An officer from the DAD also confirmed this.

'*We have been providing subsidised fertilisers to farmers for years. Therefore, farmers had fertilisers with them. They did not apply all the fertilisers to the field at once and had some fertilisers left in their homes. Farmers used those leftovers in the past few days* '(quote from a Department of Agrarian Development official).

These input stocks were depleted as farm households continuously utilized them and then, farm households were faced with input scarcity. Therefore, the use of reserve stocks was only a short-term strategy for those farm households, who initially used it.

When farm households heard about the agrochemical import ban, some purchased available fertilisers for current and future use. This was highlighted during a key informant interview with an officer from the DAD.

'*Farmers would not store fertilisers if the fertiliser prices were increased. Farmers stored fertilisers because farmers were afraid that they will never find the fertilisers again because of the fertiliser import ban'* (quote from Department of Agrarian Development official).

Few Kandy farm households, who had good relationships with the government officers, sourced fertilisers and stockpiled them. In contrast, stockpiling was not a viable option in the Central Highlands of Nuwaraeliya due to the cool climate causing the fertiliser to solidify as shown in the following quote.

'*Stocking fertilisers is useless. Fertilisers should be 100% good quality. When we stock fertilisers for three to four months, they become hardened like stones because of the cool climate here. When this happens, we don't know whether the fertilisers are effective. We don't have facilities to check the quality of fertilisers'* (quote from Mr L).

Local input stores often did not have inputs during the pandemic. A few farm households who had good relationships with fellow farm households or input store owners, and farm households who had cash in hand to spend on inputs were comparatively less impacted when accessing inputs during the travel restriction period. Because these farm households purchased inputs (e.g. seeds, fertilisers) from distant places through collective purchasing methods.

Collective purchasing brought several benefits as it increased the bargaining power of the farm households and reduced their transaction costs in purchasing inputs. Collective purchasing involved purchasing through a single farmer or a farmer collective. Only people with a travel permit were allowed to travel during the lockdown. Sometimes, a single farmer went to a distant place and purchased inputs on behalf of other farmers. Sometimes, the leaders of farmer organisations bought fertilisers in bulk, transported them and distributed them among farm households. One farmer shared his experience in this collective purchasing.

'*During COVID-19, we had to go to Hanguranketha to purchase green chillies and capsicum seeds. I went to Hanguranketha and bought 12 capsicum seed packs for four to five people. The seeds were expensive, and only one person could travel then*' (quote from Mr A).

Sometimes, farm households or traders who bought seeds from distant places 'sold' those seeds in the area, keeping a small margin.

Farm households also received some fertiliser from the government. Once the fertiliser import ban policy was in effect, the stocks in Agrarian Service Centres were rationed among farm households.

'If a farmer needs five packs of chemical fertilisers, we give only one pack of fertiliser' (quote from a Department of Agrarian Development official).

The Agrarian Service Centre did not distribute organic fertilisers to vegetable farm households. Instead, it acted as a middleman, purchasing inputs from the private sector and providing them to the farm households.

'*There are no seeds to purchase from seed farms. There are no inputs to purchase from the Department of Agriculture. Therefore, we bought inputs from distant areas in Hanguranketha, Kandy and Dambulla. We don't have a profit from that. Since farmers were waiting, we bought and sold inputs from the Agrarian Service Sales Centre'* (quote from a Department of Agrarian Development official).

The leaders of farmer organisations in Kandy purchased fertilisers from the Agrarian Service Centre on behalf of farm households and transported them to the village. The government officers supported this process as explained in the following quote.

'*At first, our officers went to the villages and obtained the data on fertiliser requirements. Then, the request was forwarded to the Department of Agrarian Development commissioner for approval from the fertilisers secretariat office. Then we purchased fertilisers from the fertiliser company and transported them here. They were transported to the villages with the support of our officers'* (quote from the Department of Agrarian Development official in Kandy).

Farmer organisation's collective purchasing benefited its members as it increased their bargaining power. This was especially important to Kandy farm households who cultivated vegetables on a limited scale, in contrast to the larger scale of Nuwaraeliya farm households. Therefore, Kandy farm households' interest in joining a farmer organisation was higher than that of Nuwaraeliya farm households. Another reason was that many farm households in Kandy cultivated paddy. The government provided fertiliser subsidies for paddy farmers, and fertiliser distribution usually occurred through farmer organisations. Therefore, Kandy farm households who grew vegetables as well as paddy enjoyed the 'spill-over' effect of being a farmer organisation member. Nevertheless, some Kandy farm households also mentioned a lack of transparency in farmer organisations' activities. For example, sometimes the farm households who had long-term, good relationships with the agricultural officers received benefits from the programmes conducted by the government, compared to the other member farm households who did not have such long-term relationships with the officers. The following quote illustrates how a farmer sees this situation.

'*It's always the better-off people in the farmer organisation who grab the benefits. There are impoverished farmers here. But people with low incomes often do not receive anything from these farmer organisations'* (quote from Mr K).

Collective purchasing through farmer organisations was not very much observed among urban farm households in Nuwaraeliya. There was a lack of farmer involvement in organisations activities in urban areas in Nuwaraeliya. The farm households had commercial-level, large-scale vegetable cultivation with high input use. Therefore, outlets of agrochemical manufacturing companies were available in Nuwaraeliya, and those input suppliers had frequent contact with some farm households. In a context where agricultural activities were declared essential, these officers could reach farm households to a certain extent. Even farm households who were not highly commercialised could access these officers and inputs. Therefore, unlike in the Kandy district, the role of farmer organisations in fertiliser distribution was low in urban farm households in the Nuwaraeliya district because they were more commercialised, competitive, and less reliant on farmer collectives. Some farm households in Nuwaraeliya cultivated leased lands in other areas that did not belong to the purview of the local farmer organisation. Therefore, they did not receive fertiliser for their cultivated lands located in other areas. For this reason, some farm households reduced their interactions with farmer organisations.

One farm household who had enterprises related to organic inputs tried to adopt to changing circumstances. However, changing enterprises sometimes lead to other adverse effects, as illustrated in the following quote.

'*When we can't find poultry manure, we started a compost buying and selling business. We used that compost in our fields, too. But later, we found that the compost was low in quality, and our leeks and beans did not grow well after we applied that compost. Our compost sales were also low. Then we gave up that compost business'* (quote from Mrs J).

Some farm households benefited from the external support. Mobile services from the DAD , the DoA, and the private sector distributed inputs among farm households during the lockdown period. There

were special programmes (*Saubhgaya programme)* by the DoA to provide seeds to farm households based on a 50% cost-sharing approach, and some farm households received seeds from this programme. An officer from the DAD explained how government organisations were involved in input supply during this period.

'*During the lockdown period, a mobile service from the Department of Agrarian Development and Department of Agriculture distributed seeds, pesticides and fertilisers. Private sector people also distributed those inputs once per week as a mobile service. Therefore, farmers could purchase those'* (quote from a Department of Agrarian Development official).

Changes in cropping pattern

Some farm households reduced the number of vegetable cultivation seasons in a year when they could not access inputs. This was a viable option among urban farm households in Nuwaraeliya as they cultivated vegetables in four seasons per year and could reduce it to two or three. One farmer from Nuwaraeliya shared his experience in the following quote.

'*We can only cultivate three seasons now because of the fertiliser problem. Otherwise, we would cultivate four seasons yearly'* (quote from Mr D).

Reducing the number of cultivation seasons as a strategy will ultimately lead to a financial impact on those urban farm households who highly rely on vegetables as an income source. In contrast, Kandy farm households did not reduce the number of cultivation seasons due to lack of inputs.

These strategies were meant to reduce the amount of inputs required. Therefore, this is ultimately linked with lower production as an impact mentioned above.

Some farm households who could not find inputs on time delayed the planting.

Kandy farm households used some unique strategies in response to difficulties in accessing inputs. One farm household shifted to off-farm activities using their resources and skills as illustrated in the following quote.

'*I moved away from vegetable farming and am providing transport services to a tea factory. I am transporting tea leaves from the farmers' field to the factory in my lorry. It isn't easy to cultivate now. Fertilisers are costly'* (quote from Mr K).

Changes in crop types

One farm household shifted their crop types from high fertiliser-consuming vegetables (e.g., Carrots, Cabbage, Capsicum) to less fertiliser-consuming vegetables (e.g., Okra, Beans, Cucumber, Brinjal, Mannioc) as a response to lack of access to inputs. This is explained in the following quote.

'*When fertilisers and pesticides were available, we grew crops such as carrots, cabbages, and green chillies. But now it isn't easy to grow such crops. Therefore, we cultivated vegetables such as okra, beans, cucumber and brinjal'* (quote from Mrs H).

However, this option was not available for Nuwaraeliya farm households as the types of vegetables they produced were highly sensitive to the fertilisers, pesticides and climatic conditions in Nuwaraeliya.

Changes in labour use

Some farm households who experienced high labour costs and difficulties accessing hired labour used different strategies. Reducing the scale of vegetable cultivation, reducing the number of hired labourers, and using family labour were the main strategies used by many farm households to cope with high labour costs and difficulties in accessing labour during this period. One farmer explained how and why he adjusted hired labour in his field during this period.

'*Ten labourers were working in my field. Now, I have reduced it to five labourers. Otherwise, it would be very costly for me. When I am paying labour wages as Rs.900 to Rs.1,300 per person, it costs above 1.5 laks [Rs.150,000] per month'* (quote from Mr K).

Some Kandy farm households and rural farm households in Nuwaraeliya used labour sharing. Farm households with adequate household members capitalised on this to fulfil labour requirements. The

family labour very often included spouses, children, and siblings. Using children for farm work was possible because the COVID-19 mitigation measures forced schools to close. Usually, kids in some areas of Kandy do not go to school during busy times on the farm. During the pandemic, many farm households could not afford hired labourers, they depended entirely on family labour for their farm work. This trend has increased recently as explained in the following quote.

'*People take their kids to the farm because of high labour costs. It's about Rs.2,000 per male labourer and Rs.1,500 per female labourer, with food. If about five labourers work in the field for three to four months, it's a big cost for the farmer. Their income is not enough to pay the labour cost. Therefore, the whole farm family is working in the field*' (quote from a Department of Agrarian Development official in Kandy).

However, with the uncertainties in the research context, many farm households did not want their children to be vegetable farmers in future. Therefore, some farm households who could afford educational expenses were keen to provide their children with a good formal education to prepare them for jobs in non-farm sectors. Nevertheless, more than half of farm households in this study shifted to vegetable farming because their parents were farmers.

Some farm households also used the support from their community members, such as neighbours and friends, to fulfil labour requirements. The use of neighbours was common only among Kandy farm households and rural farm households in Nuwaraeliya as they were often the farm household's relatives or friends. In contrast, urban farm households in Nuwaraeliya were less dependent on neighbour support because many farm households did not have relatives in their neighbourhood. They also could access labourers more easily from the urban population. Urban farm households were also comparatively large-scale farm households who competed with each other.

However, some urban farm households did receive support from friends to meet labour needs.

Late planting because of lack of access to labour during the COVID-19 mitigation measures was a unique strategy for a few Kandy farm households. Farm households were reluctant to ask labourers to come to work if they had elderly members in their households or quarantined neighbours. However, this strategy met with disaster if the planting happened too late, as happened to Mr R.

Mr R was a farmer in Kandy who cultivated bitter gourd in 0.4 ha of land.

'*I could not plant on time because some of my neighbours were quarantined. Therefore, I could not ask labourers to come. I could not cultivate on time because I did not have enough labourers. Next, the dry season came in, and I could not get an income. That's why I also did not cultivate vegetables this time'* (quote from Mr R).

In contrast, late planting was an option for Nuwaraeliya farm households who could not access timely inputs.

Labour sharing was not a common practice in vegetable cultivation because of farmers' belief in '*as waha kata waha'*[24]. However, some farm households used labour sharing pre-pandemic and it was not possible during social distancing measures during this period.

One farm household provided accommodation facilities for the hired labourers who could not come to work because of travel restrictions. The availability of accommodation facilities at the farm and cash in hand to pay the wages helped the farm household accommodate the hired labourers. Some farm households also reduced the number of hired labourers and workload (e.g. irrigation frequency). Reducing workload was supported by the favourable climate at that time as illustrated in the following quote.

[24] A common social belief among some people, that showing a good harvest to others will bring bad to the cultivation in next time.

'I reduced the number of labourers as far as possible. Because it is hard to afford. I only use four hired labourers whenever I have a lot of work. We used to irrigate twenty times per month in the past. But now I have reduced it up to ten times. Another reason to reduce irrigation is upcoming rains' (quote from Mr L).

In contrast, despite the low income from vegetables, one Kandy farm household did not reduce the number of hired labourers as they wanted to maintain the relationship with the labourers.

'*There are many vegetable farms here. If we quit our labourers, they will leave and work in those fields. We won't be able to re-catch them. Therefore, although we faced many difficulties during COVID-19, we did not quit labourers. We gave them even a little work to do'* (quote from Mrs J).

5.3.2 Marketing strategies

Marketing strategies included changes farm households made in their vegetable marketing systems to maintain their income. This included the changes related to the amount of vegetables sold, harvesting time, selling method, selling prices and crop types and markets. Marketing strategies are sometimes associated with the production strategies mentioned in the above sub-section, because some farm households changed their production system when they lost their markets.

A few Kandy farm households who could not sell their produce as expected gave up cultivating crops (e.g. cultivation of chillies in tunnels for the export market). In contrast to Nuwaraeliya farm households who reduced the number of cultivation seasons due to a lack of access to inputs, some Kandy farm households reduced the number of cultivation seasons from three to two due to a lack of access to markets during the first wave of COVID-19. Reducing the number of cultivation seasons reduced the amount of vegetables sold to the market.

The following subsections will explain the changes farm households made from harvesting to marketing during this period.

Changes in harvesting time

Since the middlemen did not come to collect vegetables as frequently as in the past, and the markets, including the Dedicated Economic Centre, were also opened only for a few days, farm households struggled to decide the harvesting time. As a result, some farm households delayed their harvesting period even for months. This was evident among some Nuwaraeliya farm households during the lockdown and fuel shortages. A key informant interview with a Dedicated Economic Centre official revealed that compared to other types of vegetables usually grown in Kandy (e.g. Okra, Knol-khol), many vegetables grown in Nuwaraeliya could be kept in the field sometimes without harvesting. This was a short-term advantage for Nuwaraeliya farm households. However, some farm households in Nuwaraeliya could not harvest potatoes on time. As a result, potatoes were overgrown and not suitable for consumption.

Figure 5-6.A lorry in the Dedicated Economic Centre Nuwaraeliya stacked with vegetables to be transported to a distant market (Source: Author)

Three urban farm households in Nuwaraeliya stopped cultivating in leased lands because of the lack of arrival of vegetable buyers. Farm households were uncertain whether they could sell the harvest on time.

Farm households tried to maintain their income by changing their income source and how they sold their crops. Farm households used different strategies for the market loss during this period. In contrast, some farm households with opportunities and resources initiated innovative solutions as alternative marketing strategies, as explained below.

Changes in marketing methods

Some farm households sold vegetables through direct marketing. This direct marketing involved door-to-door selling via family-owned stores, at the farm field, on the roadside, and through temporary vegetable stalls. The types of customers involved villagers, labourers, government officers, hotels, restaurant owners and retail stores. These were brand-new marketing strategies used by farm households which did not exist before. Sometimes, many farm households who used direct marketing added value, such as packaging the vegetables. Different types of household resources, such as the availability of a measuring scale, support from family members, marketing and communication skills of farm household members, and farm household's social relationships, helped farm households succeed in direct marketing methods. Mrs S, who used direct marketing, explained her experience.

Mrs S was a farmer in Kandy who cultivated beans, brinjal, long beans, radish, and onion on 0.1 ha of land.

'*In the past, we used to sell vegetables to the retail stores here. After only COVID-19, I started to sell packeted vegetables to retail stores. My husband, children and grandchildren helped me pack the vegetables'* (quote from Mrs S).

Another strategy involved exchanging locally grown vegetables for those grown in another area. Selling vegetables in the same village or adjacent villages was not always profitable because many cultivated

similar types of vegetables. Meanwhile, some vegetable traders came to the villages from other areas during the lockdown. Therefore, few Kandy farm households who used direct marketing exchanged their vegetables with mobile vendors and sold those exchanged vegetables within their town.

The exception was urban farm households in Nuwaraeliya who lived in areas where everyone had relatively easy access to vegetables. Door-to-door selling did not work here and was also difficult when farm households harvested a bulk amount of vegetables with no transport capabilities. However, a few farm households sold vegetables at the roadside or in temporary vegetable stalls.

Few Kandy farm households who obtained a travel permit from the government could transport vegetables to distant markets even during lockdown. Large-scale vegetable production, ownership of a transporting vehicle, and relationships with the government officers helped farm households obtain the permits. They also had a good relationship with the traders in the market. One government officer explained to whom this travel permit was issued and how those farmers could receive it.

'*During travel restrictions, no one can travel. Then, we recommend farmers who are producing on a commercial scale. Then they can obtain a travel permit through the Divisional Secretariat [a local administrative unit] office'* (quote from a Department of Agriculture official in Kandy).

Another farmer, Mr T explained the process of obtaining this travel permit.

Mr T was a farmer in Kandy who cultivated tomatoes, beans, bitter gourd, luffa, and capsicum on 1 ha.

'*The Agricultural Department recommended obtaining a permit because I had long-term relationships with them. Therefore, I did not have a big hassle when I asked for a permit. The Divisional Secretariat Officer signed the document and passed it to the Grama Niladhari officer. When he gave it to the police, I obtained a permit and transported my vegetables'* (quote from Mr T).

According to some farm households, only the traders received the travel permit, not the farm households, even the farm household had a vehicle. These traders were presumably large-scale farm households.

A different strategy was collective marketing. Sometimes, when an individual farmer's harvest was low, vegetable harvests from several farmers were collected by one or two farmers and transported to the markets. This collective marketing was only observed among some Kandy farm households.

The government initiated a vegetable purchasing programme and there were few farm households who were benefited. Vegetables were collected through the Divisional Secretariat Division level and re-distributed among the customers. Farm households received support from officers to sell their vegetables. One government officer explained this support from the government for vegetable marketing during this period.

'*We collected vegetables from farmers and tried to sell those through the government programme. And we maintained a temporary stall in Nildandahinna and sold vegetables through that stall also'* (quote from the Department of Agrarian Development official in Nuwaraeliya).

One Kandy farm household also sold vegetables to mobile vegetable traders. Some who had difficulty obtaining a permit changed their marketing channels from transporting to distant markets to selling to traders in the village at a low price as illustrated in the following quote.

'*With Corona, they asked us to obtain a permit to transport vegetables. But it needed approval from several people, and we had to go behind many officers. We also don't have a vehicle and occasionally hire different vehicles to transport vegetables. The permit was issued to the lorry owner, not to the farmers. Therefore, because of this hassle, I didn't want to try that, and I sold the vegetables to the traders here'* (quote from Mr E).

A key informant Interview in Kandy revealed an increase in new farm households joining the GAP programme as a strategy to find new markets in the private sector supermarkets. The vegetables grown under the GAP programme had a higher consumer demand than non-GAP vegetables.

Changes in selling prices

Whenever middlemen arrived, many farm households sold the vegetables to the middlemen at very low prices as farm households could not access other marketing channels.

Some farm households did not harvest and left vegetables in the field to decompose as this was the only option for some farm households when they could not sell. In contrast, some Nuwaraeliya farm households did it purposefully as they believed allowing vegetables to become compost would enrich soil nutrients, which is more profitable than selling vegetables at low prices. The following quote further explains this:

'*When we spend about Rs.7,000 as the lorry hire and sell this at a price of Rs.15 to 20 per kilo, it's useless. We have to pay for the refreshments and wages for the labourer. Once everything is over, it is very unprofitable for us to transport and sell this at a very low price. It is better to leave vegetables in the field to be composted than to sell them at low prices. Then, it will become manure. Many farmers did that; farmers did not harvest knol-khol and tomatoes and left in the field without harvesting'* (quote from farmer group discussion in Kandy).

Although leaving the harvest to become compost was a pre-existing strategy among Nuwaraeliya farm households, the frequency of doing that increased during this period because of the uncertainties in the market.

Some farm households who had good relationships with their community and farm households who believed in good fortune shared unsold vegetables with others for free. This happened because farm households lost their markets.

'Salad leaves were priced at about Rs. 100 per kilo. But no one came to purchase salad leaves from us. Therefore, we gave salad leaves to the nearby homes for free' (quote from Mr D).

A farmer in Kandy obtained dried bean seeds when he could not access middlemen during the lockdown period. However, these dried bean seeds were also destroyed due to fungal attacks, and the farmer had to distribute the leftover seeds among villagers for free.

Changes in the crop types and markets

Few Nuwaraeliya farm households who used to cultivate specific crops (e.g., spices) for particular markets (e.g. hotels) shifted to growing crops that could be sold to the local markets.

5.3.3 Financial hardships strategies

Farm households also used financial hardships strategies to respond overall financial difficulties they experienced during this period at household level.

Borrowing

Loss of income and increased costs led some farm households to borrow money during this period. Borrowing was common among farm households across the two case sites even before the pandemic. However, after the pandemic, borrowing by some farm households increased. Because their costs were more significant and they could not repay their debts. Other farm households lost their income. As a result, they had to start borrowing. Farm households borrowed for various reasons, including buying essentials (e.g. foods and inputs) and covering essential payments (e.g. Death Benevolence Society[25] membership fees, family medical costs, labour wages, monthly leasing installments, rents, transport costs).

Farm households borrowed from formal and informal credit sources. The formal credit sources included government banks (e.g. Bank of Ceylon, Peoples Bank, Samurdhi Bank, Rural Bank, Development Bank, Cooperative Bank, Kandurata Bank, Agrarian Bank in the Department of Agrarian Development), private banks (e.g. Hatton National Bank). When farm households needed a big amount of cash, they borrowed from the government and private banks. In contrast, if they needed a small

[25] A village level community collective which provides benefits to its members during funerals in their households.

amount of money (e.g. Rs.25,000-30,000), they borrowed from the Agrarian Bank in the DAD. Formal credit sources involved about 10 to 11% interest rates, and farm households generally had to produce collateral or guarantors when borrowing from formal credit sources.

Informal credit sources included family members, relatives, fellow farmers, friends, vegetable collectors, input providers and sometimes money lenders. Usually, borrowing from informal sources was quick and did not require guarantors. Some informal money lending organisations gave farm households daily loans with high-interest rates. These everyday loans are more accessible for farm households but must be paid weekly or daily, sometimes with an interest rate of 160%. Farm households used different mixes of formal and informal credit sources.

Some Kandy farm households also borrowed from farmer collectives such as the *'Sithamu'* women's society. A key informant interview with the Department of Agrarian Development official in Kandy revealed that the borrowings from this women's society increased during the pandemic. The loan amount that could be obtained from *Sithamu* Women Society was generally about Rs. 10,000-20,000. If a member needed a slightly higher amount, they could get it through the Agrarian Bank in the DAD. Farm households borrowing from some Agrarian Banks in Kandy increased during the pandemic. An officer from the Department of Agrarian Development explained the increase in borrowings during this period as follows:

'*Now everything is costly, and farmers cannot afford it. Normally, farmers harvest vegetables, sell them, and save some money to purchase inputs for the next season. This was difficult this time, and farmers tend to borrow'* (quote from a Department of Agrarian Development official in Kandy).

Some Kandy farm households borrowed non-financial inputs from private input stores and Agrarian Service Sales Centres. Even though borrowing inputs benefited farm households who did not have the cash to purchase inputs, borrowing inputs were sometimes disadvantageous for farm households. When farm households purchased inputs for money, they could buy inputs at a discounted price from input stores. However, when farm households borrowed inputs from input stores, the inputs were

issued at an undiscounted price. Therefore, continuing to borrow inputs increased farm households ' overall production cost. This type of non-financial borrowing by farm households did not continue when the input scarcity in the area became severe.

The Agrarian Bank had a special credit programme for farm households in which only half of the requested credit amount was given as cash. In contrast, the remaining amount was issued as inputs from the Agrarian Service Sales Centre. Farm households perceived some disadvantages with this credit programme. The Agrarian Service Centre often did not have adequate amounts of input stocks, and farm households had to wait to obtain inputs, which delayed the production process. Therefore, many farm households preferred to receive the entire loan amount as cash from the Agrarian Bank's credit programme. If farm households had cash, some purchased inputs from private sector input suppliers. Therefore, for some Kandy farm households who cultivated paddy and vegetables, the only reason to borrow inputs from the Agrarian Service Centre was to maintain the relationship with the DAD and remain eligible for fertiliser subsidy which was distributed through this organisation as illustrated in the following quote

'Since we want to maintain our relationships with Agrarian Service Centre, we borrow Rs. 50,000. Otherwise, borrowing one lak [Rs.100,000] from the Samurdhi bank is better than borrowing from the Department of Agrarian Development as Samurdhi bank gives us the full amount as cash' (quote from a participant in farmer group discussion Kandy).

An interview with the Department of Agrarian Development officers revealed that, during the third wave of COVID-19, the Department of Agrarian Development had revised its credit programme policy to provide farm households with the total credit amount in cash.

In contrast, for several reasons, non-financial borrowing from Agrarian Service Centres was not evident among Nuwaraeliya farm households. There were no adequate inputs available in Agrarian Service Centres to lend to farm households as the data collection time in Nuwaraeliya was the peak period of input scarcity. Farm households also considered borrowing inputs from the Agrarian Service Centre to

disadvantage them as they could purchase the equivalent amount of inputs from the private sector at a comparatively lower price. This happened because the Agrarian Service Centre bought inputs from the private sector and sold them to the farm households after keeping some margin.

There was a lack of interest from some Nuwaraeliya farm households to borrow from the Agrarian Bank. The maximum loan amount Agrarian Bank issued was Rs. 75,000, which was inadequate to fulfil the production cost of comparatively large-scale farm households in Nuwaraeliya. The urban farm households had relatively easy access to input providers from whom they purchased or borrowed inputs. For example, farm households who cultivated potatoes received pesticides from the private sector input suppliers for potatoes. Many urban farm households also had easy access to other credit sources, such as government and private sector banks. Therefore, urban farm households could easily access financial services from banks to purchase inputs compared to other farm households with little access to established financial services. Nevertheless, credit access from banks depended on the farmers' ability to produce collateral or guarantors. Farm households who had good social relationships, used relatives or friends as guarantors. Despite living in an urban area, it is doubtful a farm households could obtain formal credit from the government or private sector banks unless the farm households have a land title, as illustrated by the situation with Mr Q:

'*We don't have ownership of our land right now. But we can live and cultivate this land. But if we request a loan, we should have a clear deed for this land to use this land as collateral'* (quote from Mr Q).

Farm households often mortgaged jewellery or their cultivation lands to obtain loans from private banks. Irrespective of the high interest rate, some farm households preferred mortgaging jewellery in private banks compared to government banks as they received higher loan amounts from private banks. Mortaging jewellery was a pre-existing strategy to source finances among many farm households in both case study sites. Usually, farm households pawned jewellery to source finances to cover the cost of production. Farm households repaid this loan once they received income from

vegetable selling. However, because of the unexpected and continuous shocks during this period, including market disruptions, farm households could not repay their debts and obtain their jewellery back, as they had in the past. For example, Mr F had difficulties repaying the loans, as illustrated in the following quote:

'My jewellery is in the bank. I did this also in the past. What I usually do is when I sell the vegetables, I repay the loan and get back my jewellery. But this time, I could not repay the debt so far and release the jewellery' (quote from Mr F).

Borrowing from the banks also required the Department of Agrarian Development certification to confirm that the loan applicant was a farmer. The time spent to obtain a loan was an essential factor for farm households to choose the most convenient source of credit. A longer loan processing time reduced the farm households' desire to borrow, irrespective of the low interest rate from the credit source. Farm households also chose the credit source from which they could obtain the most money.

Informal borrowing from closely related community members was positively associated with farm households ' belief that their social networks would support them during times of financial need. Kandy farm households and rural farm households in Nuwaraeliya resided close to their relatives and family members. One farmer explained how a fellow farmer helped her to pay the labour cost.

'We normally borrow from each other in emergencies. I recently did not have money to pay the labour wages, and then I borrowed from him [a fellow farmer] to pay labour wages. We must pay labour wages on time, and I can get his [a fellow farmer] support' (quote from Mrs J).

An exception was few urban farm households in Nuwaraeliya who borrowed only from family members. Because of the area's competitive nature of vegetable farming, many urban farm households were reluctant to borrow from fellow farmers, so this practice was less evident among urban farm households in Nuwaraeliya. This was particularly prominent for farm households who resided in an area surrounded by people from a different ethnic group. One farm household who had

moved to the Nuwaraeliya from another part of the country were culturally diverse from their neighbours and he explained his experience.

'*There are only two to three Sinhalese[26] families here. Non-Sinhalese people here are also good, and we live in harmony. But we don't have anywhere to go, and we don't have anyone to borrow from'* (quote from Mr Q).

Some farm households also commented that informal borrowing from family members would not be possible in the long run because of the gradually increasing cost of living and this is illustrated by the following quote.

'I usually borrow from my sisters, but I can't borrow from them daily as they also have problems' (quote from Mr L).

The data from Kandy farm households showed farmer organisation members could access formal credits from some institutes, such as the Department of Agrarian Development. No clear evidence was found among Nuwaraeliya farm households that farmer organisation membership influenced credit access.

Prior to the pandemic, farm households borrowed from vegetable collectors and input providers at the beginning of cultivation and repaid the loan once the harvest was sold. This mechanism did not work well with many farm households because of the input scarcity, lower yield and high input prices during this period.

Rural farm households in Nuwaraeliya borrowed from private money lenders with a high monthly interest rate of about 20%. Few farm households borrowed from money lending organisations that provide daily loans with high interest rates. A government officer explained this situation.

[26] An ethnic group in Sri Lanka

'In those days when people didn't have money, they borrowed from lenders and got into trouble. This is because it is difficult for the people to find the guarantors to apply for a bank loan' (quote from the Department of Agrarian Development official in Nuwaraeliya).

Because of the continuous financial impacts farm households faced during this period, many farm households borrowed from one place and then borrowed from a second source to repay the first loan payment. This type of 'credit rotation' was observed among many farm households. There was one farm household which used their skills to repay the loan through providing service as shown in the following quote.

'*Once the lockdown is lifted, I did some carpentry work for them to repay the loan I obtained*' (quote from Mr N).

However, as highlighted in a farmer discussion, borrowing was also inadequate at times to cover the increasing cost of production

'*If we obtain a cultivation loan of Rs.100,000, it will be over once we purchase fertilisers. No money is left to do anything else'* (quote from farmer group discussion in Kandy).

There was also evidence that one farm household did not use the borrowed money for the intended purpose, which will again trap the arm household in the debt cycle. This is illustrated in the following quote.

'I borrowed from the Samurdhi Bank and Bank of Ceylon. It was given for turmeric cultivation. However, I did not cultivate turmeric and used that money to make compost. But now I don't have any income from compost, but anyhow I have to pay the loan also' (quote from farmer group discussion in Nuwaraeliya).

Reducing consumption

Some farm households reduced consumption by reducing expenses on food, travel, clothes, and other essential household items. Many farm households reduced food consumption by reducing the types

of foods consumed or the number of daily meals when they faced difficulties accessing essentials. The following quotes show examples of how farm households reduced food consumption and expenses associated with the New Year celebration.

'*We can't eat three meals per day now. So, we eat at about 3 pm, having breakfast, lunch, and dinner together*' (quote from Mr Q).

'*We did not go anywhere for this new year, so we did not want to spend on new clothes. When there was a lockdown, we reduced the number of dishes we prepare for a meal from three to two*' (quote from Mrs H).

One Kandy farm household consumed wild foods due to difficulty accessing food during the lockdown period, whereas none of Nuwaraeliya farm households consumed wild food as a strategy.

Reducing consumption had different reasons at different times. For some farm households, it was because of the lockdown at the beginning of this period as shown in the quote from Mrs H below, while for others, the high prices of essentials emerged in the later part of this period.

'*Sometimes when we prepared a big lunch, we saved it for Dinner as we could not find a variety of foods during the lockdown'* (quote from Mrs H).

'*Life is tough, and everything is expensive. Ultimately, we will have to die hungry'* (quote from Mr Q).

Using savings

Some farm households used their financial savings to buffer the income loss as illustrated in the following quote.

'*I have saved some money, so I did not want to do some other work. I used those savings so far. Even now, I am using my savings'* (quote from Mr C).

Selling assets

One farm household with other physical resources, such as livestock (e.g. goats), sold them. Selling livestock was observed in a farm household in Nuwaraeliya , as a response to the increased cost of living.

One Kandy farm household members also sold their assets at the pandemic's beginning to reduce costs and the farmer explained what made them sell their assets.

'*We had a bus. During the COVID-19 period, we could not transport extra passengers. They [the police] asked us only to accommodate half an amount of seats on the bus, and we also had to maintain the bus regularly. The income was not enough to cover that cost. So finally, my son sold the bus'* (quote from Mrs S).

Relying on extension periods to repay the loans

Some farm households with good relationships with the officers received an extension period to repay their bank loans.

Giving up cultivation on leased lands

Giving up cultivation on leased lands was one of the unique strategies among some urban farm households in Nuwaraeliya. Some farm households in Nuwaraeliya cultivate leased lands, and the lease payment for ten perch (0.02 ha) land was about Rs.25,000 per year. Many farm households who grew on leased lands could not make timely lease payments due to low vegetable income. Therefore, some farm households who could not make the lease payment quit cultivating the leased lands. One farm household was encouraged to quit the leased lands when they observed that their peer farmers (sometimes agricultural officers who cultivated vegetables) did the same. The growing uncertainty in the country also triggered farm households to give up cultivating in leased lands as shown in the following quotes.

'*Before COVID-19, I cultivated about 2.5 acres [1 ha]; 2 acres [0.8 ha] were on my own land, and 0.5 acres [0.2ha] were on leased land. My leasing period was over, and the owner asked me to make the*

lease payment. But, I did not have money to make the lease payment. Everyone told us that COVID-19 will continue, so we won't be able to manage the leased lands. So, I returned that 0.5 acres land' (quote from Mr F).

'I could not pay the lease and gave up 3 acres [1.2ha] of leased land' (quote from Mr L).

In contrast, two Kandy farm households who cultivated leased land could receive an extension period to pay the lease or keep the land even without paying the payment on time. One of the probable reasons for these contrasting findings about leased lands in the two case sites might be the low level of uncertainty in the country during data collection in Kandy compared to the data collection time in Nuwaraeliya. Kandy farm households had plans to cultivate leased lands in the future. The farm households who continued to keep the land had long-term relationships with the landowners and had also taken some measures to develop the leased lands (e.g., soil conservation practices). Therefore, it was advantageous for the landowners to keep the land with the same farm household. This reciprocal relationship with the landowners helped farm households keep cultivating leased lands even without making the lease payment on time. This was the situation with Mr T as shown in the following quote.

'*The lease is Rs.40,000 for 2 acres [0.8ha] for a year. My income was reduced, and I could not pay the lease. Since I am leasing every year, the landowner gave me a chance to pay it in the next year. I have put terraces and other soil management practices to the land'* (quote from Mr T in Kandy).

In Nuwaraeliya, because of a plethora of vegetable farm households and higher demand for land, generally, if a farm household cannot pay the lease, another farm household would willingly take it up. In contrast, the same situation did not exist in Kandy. Therefore, unlike Kandy farm households, Nuwaraeliya farm households could not keep the leased lands with them longer without paying the land lease. The higher level of socio-economic uncertainty presumably discouraged Nuwaraeliya farm households from proceeding with leased lands.

Relying on financial support from household members

Some farm households received financial support from their household members. This included income sharing of parents and cash gifts from married children.

One farm household were financially supported by household members returned from urban areas and started a new income-generating activity, which was directly marketing processed vegetables to hotels and restaurants. Different resources and opportunities, such as the availability of transport facilities, relationships with the villagers and buyers, and support services from the government to initiate new enterprises, enabled this household members to start new income-generating activities. The farmer explained his experience:

'My son buys carrots and leeks from the farmers here. Then, he cut those vegetables, dried them (Figure 5.7) and made 25 to 30 kg packets daily. He obtained a self-employment permit from the AG office [Divisional Secretariat Office] and sold those processed vegetable packets to restaurants. To make fried rice, restaurant people need carrots and leeks. With the support from a leasing company, my son purchased a motorbike to travel and transport vegetables over long distances' (quote from Mr Q).

Figure 5-7.Cleaned and cut vegetables drying in the sunlight to get ready for direct marketing (Source: Author)

However, this type of domestic business was also disrupted by other issues, such as fuel shortages and changes in input and vegetable prices.

5.3.4 Strategies for household wellbeing impacts

Farm households used different strategies to respond to the household wellbeing impacts they faced during this period. Some of the strategies were purposeful actions, while some were the options farm households were left with at that time. This included receiving the support of household members or fellow farmers during the quarantine period, using new technologies such as WhatsApp to communicate with extension officers, receiving support from *grama niladhari* officers to access health facilities during travel restrictions, using experience of farmers or their parents for farming, use of online learning methods by school children, initiating new enterprises, stockpiling of essentials (e.g. food, medicines), and purchasing food by mobile vendors. Many of these strategies were common to others in Sri Lankan society at that time.

Many did not have strategies for accessing fuel because they did not have alternative energy sources such as firewood as illustrated in the following quote.

'*When we enter the forest, the guard will catch us. It is fair enough. Entering a conserved forest for picking a dried branch for firewood is illegal. People have neither gas nor firewood'* (quote from Mr Q).

The exception was some rural farm households in Nuwaraeliya who could continue their livelihood using alternative energy sources; some options were pre-existing, whereas some were new.

Mr U was a vegetable farmer in Nuwaraeliya. In addition to vegetable farming, he was also involved in off-farm income-generating activities, such as providing catering services to the school and hospital in the area and working as a driver.

'*We never used gas to cook at home. We use firewood to cook at home. We maintained a canteen in the hospital and used to cook using the gas burner. We use kerosene to cook in the hospital canteen because we can't find gas. There is a kerosene burner in the hospital'* (quote from Mr U).

Although the main impacts of the shocks on farm households during this period was negative, some farm households also had some positive impacts as outlined below.

5.4 Positive impacts on farm households

Some farm households made use of opportunities that emerged during this period. This was primarily related to the government policies, market behaviour and farmer circumstances during this period.

For example, during this period, the government of Sri Lanka banned the import of some food items, including turmeric. Turmeric was an essential spice used in cooking and had medicinal value. Especially during this pandemic, turmeric was in high demand due to its therapeutic value to combat viruses. Therefore, the turmeric import ban provided some opportunities for some Kandy farm households. Vegetable farm households who used to cultivate turmeric increased the scale of turmeric cultivation and received an income from selling turmeric. One farm household who had family support, necessary skills, knowledge and entrepreneurial attitudes sold processed turmeric powder to relatives and friends. In contrast, another farm households sold unprocessed turmeric to middlemen (about ten kilograms of raw turmeric is required to make one kilo of turmeric powder). Selling processed turmeric powder was more profitable than selling raw turmeric. The social relationships, skills, and knowledge in turmeric cultivation and processing also helped these farm households succeed in this business. The following quote from a turmeric farmer (Mrs V) illustrates how this policy change positively affected their interest in turmeric production.

Mrs V was a farmer in Kandy who cultivated tomatoes in 0.4 ha and turmeric in 0.2 ha.

'We cultivated turmeric also in the past, but we did not have a market and gave up. But now there is a market for turmeric because of a lack of imports. Therefore, we enthusiastically started cultivating turmeric on a large scale' (quote from Mrs V).

In contrast, some farm households who cultivated turmeric could not earn a good income by selling turmeric to middlemen due to damage from extreme climate and low prices received. These farm households believed cultivating vegetables was better than growing turmeric if they had adequate inputs as illustrated in the following quote from Mrs W.

Mrs W was a farmer in Kandy who cultivated brinjal, okra, long beans, beans and manioc in 0.2 ha and turmeric in 0.2 ha of land.

'Cultivating vegetables is better than cultivating turmeric. It takes about one year for the turmeric to grow up to the harvesting stage. It's been about one year since I planted turmeric, but the plants have not yet dried. Planting rates of turmeric are different, and we will also not receive an income despite the big effort put in for turmeric production' (quote from Mrs W).

Income from turmeric was not available for urban farm households in Nuwaraeliya . The cooler climate in Nuwaraeliya was not favourable for turmeric production.

The government policy on agrochemical import ban also positively affected some farm households. During the input scarcity, the overall vegetable production was reduced, and the farm households who managed to cultivate vegetables could sell their vegetables at a reasonable price. One farm household believed because of the low use of chemicals, the damages from pests were also reduced during this period. Mr X was a farmer in Kandy who cultivated luffa, tomatoes, green chilies, bitter gourd, and beans in 0.4 ha. He also has three cattle. He shared his experience:

'If fertilisers were available, people would produce more. Then, we would be unable to sell, and prices would not be this high. It's because farmers are growing less, I received a good price. This time, I didn't use pesticides as I had before. I used pesticides only a few times. But this time, I don't have problems

with fruit flies. I don't know whether it's because of the low use of fertilisers. I suspect it's from fertilisers fruit fly might have come from' (quote from Mr X in Kandy).

Some farm households who sold vegetables door-to-door could sell them at higher prices than the pre-pandemic level because they could sell vegetables directly to the customer at the retail price. If farm households sold vegetables to the middlemen, farm households received the wholesale price, which is lower than the retail price (In contrast, few farm households faced the opposite. Because the customers were villagers, they could not sell vegetables at a high price, and sometimes, they had to sell vegetables for credit or for free).

Because of the travel restrictions and market closure, customers purchased vegetables from farm households who brought them to their doorstep. Even after the lift of lockdown, people were reluctant to travel because of the fear of getting the virus. People's reluctance to move favourably affected farm households who practiced door-to-door selling of vegetables. Other factors, such as the cultivation of uncommon vegetable types (e.g. local yams), perishability and quality of the vegetables, relationship with the customers, support from family members, availability of required resources (e.g. measuring scale to weigh the vegetables), enabled farm households to reap financial benefits from direct marketing methods The following quote explains how a farm household did direct marketing.

'My son had a shop in the past, so we had a measuring scale. I weighed two to three kilos of vegetables and sold them to the villagers and officers. I even sold packeted vegetables to the stores in the town; they liked to purchase them. Because my vegetables are fresh and of good quality' (quote from Mrs S).

Door-to-door selling was an innovative strategy for all the farm households who practised it during the market closure. Some farm households stopped door-to-door selling once the usual marketing channels were re-started. In contrast, two farm households continued to sell their vegetables door-to-door as it was more advantageous than selling to a retailer or a wholesaler. Door-to-door selling of vegetables triggered some farm households to expand their scale of vegetable cultivation. Direct marketing of vegetables brought financial advantages for some farm households when their other

household income sources were uncertain due to business closures and travel restrictions as explained by Mrs Y.

Mrs Y was a farmer in Kandy who cultivated vegetables in 0.04 ha of land.

'My husband worked in Colombo. His salary is not enough for our expenses and expenses for kids' education. He could not come home because of travel restrictions. Then I cultivated some yams and sold them to houses' (quote from Mrs Y Kandy).

Two farm households who had grocery stores could sell their products at a higher price because people could not go to the town frequently to purchase groceries at cheaper prices. Therefore, the items in these village groceries were sold very quickly.

COVID-19 restrictions sometimes let some farm households connect with other farm households and extension officers. Since the farm household members could not attend other livelihood activities, they had to engage in farming more frequently. Even among the general public, there was a trend for home gardening, and they sought the support of officers to find seeds. During fertiliser shortages, some farm households also frequently contacted officers seeking fertilisers. These lifestyle changes increased the interactions among different groups as illustrated in the following quote.

'….With the COVID-19 situation, the relationships with the farmers were increased. Some farmers searched our mobile numbers and contacted us over the telephone. We had not met those new farmers before' (quote from a Department of Agriculture official).

Less than five farm households used new technologies such as WhatsApp to communicate with extension officers, a new strategy after COVID-19. WhatsApp helped share detailed information, such as photos of diseased plant parts. Farm households used their mobile phones or the mobile phones of their family members to use this new technology, as explained by a government agricultural officer.

'When COVID-19 began, we could not go to the field; some farmers contacted us through WhatsApp. They received the support of their children to access WhatsApp' (quote from a Department of Agriculture official).

There were some findings which will be useful to understand the context with farm households and it will be presented in the next section.

5.5 Broad-scale impacts and possible future implications

There were some general observations were made related to farm households. This included some impacts on farm households and their strategies, farm household activities, and their interactions with the environment and community, which possibly linked to the community level. Some of the information presented below will also associated with the general society. Although presenting and discussing this information is not directly related to the research questions of this study, these findings will suggest long-term and broad-scale impacts on farm households and the farming community in general. Diluting the social cohesion associated with farmer organisation, youth out-migration for off-farm jobs, and reducing the scale of vegetable cultivation were observed as distinct changes associated with farmer community during this period.

Disruption of social cohesion was apparent in the relationship between farm households and their collectives. A farmer organisation was a leading farmer collective at the village level, and fertiliser distribution was one its primary duties. Because of the government policy on agrochemical ban, the role of farmer organisations was diluted, and there was a lack of interest among farm households to attend farmer organisations' activities. Lack of participation in farmer organisation activities reduced the opportunities for farm households to access information and interact with fellow farmers and officers. The reduced interactions would hamper social cohesion associated with farmer organisations, especially in the Kandy district and rural areas in the Nuwaraeliya district.

Farm households faced continuous shocks during this period, so many of them could not continue vegetable production successfully. On the one hand, necessities such as inputs and financial capital were not adequate to carry out any agricultural activity. On the other hand, the income received from agricultural activities was very often low and uncertain. Because of these reasons, farm household members, often some youth, shifted to off-farm jobs. Some of these members started off-farm jobs in their villages (e.g. working as a three-wheel driver) while some migrated to urban areas searching for off-farm jobs (e.g. joining the army as an army officer, working in construction fields as labourers). This was observed only among some Kandy farm households. Although the lack of interest among youth in farming was not a new trend, the impacts of the pandemic and other shocks have triggered the usual trend of youth to move away from agriculture as illustrated in the following quote.

'Not like in the past, now not many farmers get together and do farm work together. Not many farmers today. It's only the elders like us. Girls nowadays are not doing farm work. They go to work in garments. Others also go to work in buses or carpentry. Even they would like to go behind a carpenter as a supporter' (quote from Mrs S).

However, the older generation will continue farming despite several shocks as explained by a government agricultural officer.

'These are traditional farmers. They will never give up farming despite various problems. It's customary for them' (quote from a Department of Agriculture official).

Many lost their employment during the COVID-19 period. People working in the tourism sector were mainly at significant risk as there was no tourism during COVID-19. Some hotel employees were asked to resign due to the collapse of businesses. The employees who left hotels moved to other jobs to feed their families. This was explained by a farmer as follows.

'I worked in a reputed hotel in Thannekumbura in Kandy for five years. They had a staff of about 350 people. With the COVID-19, they gradually reduced the workforce. Each month, about 10-15 employees

resigned. All the people who left were married people, and they started to work in construction sites as labourers to feed their families '(quote from Mr G).

These changes will result in a significant change in the country's labour dynamics and social structure. There was evidence that youth who migrated to other areas were addicted to harmful drugs.

Because of many uncertainties in vegetable production and marketing, some farm households reduced the scale of vegetable production. Some Nuwaraliya farm households are planning to shift to livestock management (although some farm households did not consider rearing livestock as an option because of the lack of grazing lands in the area and time spent to receive an income). Ultimately, the extent of vegetable production in the area will be reduced. Given the significance of vegetable production in Nuwaraerliya in local food supply, reducing vegetable cultivated lands will negatively affect future food supply. Many people work as labourers in vegetable fields, and reducing the scale of vegetable production will also hamper their income sources.

There was food waste during this period. Unsold, mostly perishable vegetables were wasted either on the farm or in the markets, negatively impacting vegetable supply and vegetable prices. The loss of farmers' self-pride as net food producers can be identified as another impact of continuous shocks during this period. This was highlighted in a farmer group discussion.

'*Even beggars are not desperate like us'* (quote from farmer group discussion in Nuwaraeliya)

Large-scale private sector input suppliers were on the verge of collapse due to a lack of input and the financial crisis. The local input supply will create a big vacuum if these businesses collapse as shown in the following quote.

'Half of the country was catered from ……..[name of an input supplier] in Dambulla. People go to Dambulla by lorries to bring back inputs from ……..[name of an input supplier] It includes fertilisers, other chemicals, seeds and everything. This shop will cease its operations because it does not have

inputs to sell to farmers. If it happens, it will be a big loss for farmers' (quote from a Department of Agrarian Development official)

Farm households used different strategies to cope with the financial impacts and sometimes, these strategies also have short-term and long-term implications at a broader level. For example, since this is the National New Year period when people wear new clothes, prepare New Year foods, and visit relatives and friends, cutting down these expenses meant farm households could not celebrate the National New Year. Therefore, reducing consumption at the farm household level also impacted the social cohesion associated with national events. Meanwhile, reducing consumption to reduce costs negatively impacted the health and well-being of household members, especially children. Lack of long-term food consumption will lead to increased child malnutrition among these households, ultimately affecting the source of human capital in the country.

5.6 Conclusion

The findings of this study was presented in this results chapter. There were two types of impacts on farm household; financial impact and household wellbeing impact. This chapter illustrates the predominant impact of shocks on vegetable farm households during the pandemic period was financial, mainly due to decreased income and increased costs. Farm household income was decreased due to decreased production and loss of markets. Access to inputs and labour was constrained during this period mainly due to travel restrictions, government policy on agrochemical imports and fuel shortage. In addition, the harvest of some farm households was destroyed due to extreme climatic events. These reasons reduced vegetable production as well as the household income of many farm households.

Many farm households who managed to cultivate could not source markets due to travel restrictions and fuel shortages. Prior to the pandemic farm households in this study sold their vegetables through different marketing channels. Urban farm households in Nuwaraeliya who cultivated specific types of

vegetables for niche markets, were highly impacted by market closure compared to other farm households. Loss of markets negatively impacted farm household income.

Household costs were increased mainly due to high cost of inputs. Farm household costs were increased also for reasons unrelated to vegetable production and marketing. The cost of essentials (e.g. food, medicines, fuel) went up dramatically, as a consequence of the financial crisis in the country. Household members who worked in urban areas returned home, increasing total household costs. In similar to other general public, farm households in this study also experienced other household wellbeing impacts such as disrupted social life, disrupted non-farm income sources, difficulties in accessing services including health and education and loss of access to livelihood essentials.

Farm households in two case sites developed various strategies to respond to the financial impacts they experienced, mainly focusing on maintaining household requirements instead of maximising profits. These strategies included the changes farm households made in their production and marketing systems. There were also financial hardships strategies used by farm households to respond the financial impact on their household.

Strategies related to production included changes related to seeds and agrochemical use, cropping patterns, crop types and labour use, whereas strategies related to marketing included changes related to the amount of vegetables sold, harvesting time, selling method, selling prices and crop types and markets. There are overlaps between strategies related to production and marketing because some farm households changed their production system when they lost their markets.

Direct marketing of vegetables to villagers and government officers was a distinct strategy related to marketing systems used by some rural farm households in Kandy. Since the main impact was financial, farm households developed financial hardships strategies such as borrowing, reducing consumption, using savings, selling assets, relying on extension periods to repay the loans, giving up cultivation on leased lands and relying on financial support from household members. There are other strategies, such as using online communication methods to connect with the officers and others in the

community, starting new enterprises and stockpiling essentials used by farm households to respond to the other household wellbeing impacts.

The conditions created by different shocks in this period positively impacted some farm households. The government’s turmeric import ban policy benefited some farm households that cultivated turmeric. Using direct marketing as an alternative marketing channel was advantageous for some farm households during market closure. The next chapter will discuss this study's main theoretical and practical impactions derived from the findings presented above.

6) DISCUSSION

6.1 Introduction

This chapter connects the literature and study findings based on the research context. This chapter will discuss the study findings to answer this study's research question: how did Sri Lankan vegetable farm households respond to the impacts of the COVID-19 pandemic, and why? Drawing on the literature, research context, and empirical findings, this study describes the impacts on smallholder vegetable farm households in Sri Lanka from the pandemic, and the other shocks that occurred during this period. The primary impact of the pandemic period on all the farm households was financial. Thus, the results and discussion of this study were based on the farm households' responses related to financial impact.

The impact of the pandemic on farm households varied across households. As a result, the strategies of farm households also varied, reflecting the impact on the household and their ability to respond. This ability was shaped by farm household characteristics and vegetable production and marketing systems, as well as climate, and government policies. This chapter will discuss the nature of the impacts and how strategies developed by households, household capitals, and livelihood strategies are linked with the impact of the pandemic on smallholder vegetable farm households in Sri Lanka. This chapter consists of three subsections. Subsection 6.2. introduces the characteristics of the case and sub-section 6.3 will discuss the nature of shocks on farm households. The sub-section 6.4 will discuss the impacts of shocks and farm household responses. Subsection 6.5 will discuss the household capitals and household coping strategies and it will be followed by the discussion on dynamics of coping strategies in subsection 6.6. Subsection 6.7 will discuss relevant government interventions during the pandemic and sub subsection 6.8 will conclude with the main findings.

6.2 Characteristics of the case

This section summarises the characteristics of the case that have emerged as shaping the results from this research. These aspects define the case of smallholder vegetable farm households in Sri Lanka and are also drawn on in discussing the findings from this research.

Farm household characteristics in this study varied. Farm households included relatively poor subsistence farm households who mainly produced vegetables for home consumption and relatively wealthier and more commercialised farm households who mainly produced for markets. All farm households earnt their household income through a varied mix of on-farm and off-farm activities.

The types of production systems varied across households. Although all households cultivated vegetables some households cultivated other crops (e.g. paddy, turmeric, tea, coffee, pepper) and some were involved in rearing livestock (e.g. dairy cows, poultry). The types of markets accessed also varied and smallholder households participated in one or a mix of three types of vegetable markets: specialised markets for which no alternative market existed (e.g. international tourists markets), specialised markets for which an alternative market existed (e.g. local tourist market) and local produce markets (e.g. dedicated economic centres).

The vegetable smallholders mainly obtain their inputs from the government and private sector institutions. Many of the inputs required for vegetable production (e.g. chemical fertilisers, pesticides) are imported and this is regulated and controlled by the government. Vegetable farm households purchased chemical fertilisers at market prices unlike the paddy farmers who could access chemical fertilisers at government subsidised prices. In terms of land use, there is no legal requirement to continue vegetable cultivation in existing vegetable cultivated lands. This means vegetable cultivation could be replaced by cultivating another crop or land could be kept without cultivating any crop at all (in contrast, paddy cultivated lands could not be used for any other purpose).

Financial services are an important input for these farm households, and they borrow from different sources including banks. Farm households who borrow from banks could access credit either or both from government and private sector banks. Access to credit from banks was dependent on farm

households having the required collateral or a guarantor for the loan. Only some farm households had the ability to produce a collateral or guarantors.

The government plays a patriarchal role in the country; therefore, the farming community expects to seek assistance from the government when needed. The government intervenes in providing access to inputs, free extension services, and cultivation loan schemes. The government provides marketing infrastructure (e.g. establishing Dedicated Economic Centres), but it does not intervene in markets. The vegetable prices are decided in the open markets. There are established programmes implemented by the government that provide support for farmers (e.g. providing fertiliser subsidy, providing cultivation loans) and for needy people in the general public, which also includes farmers (e.g. *samurdhi* poverty alleviation programme).

The influence of political affiliations is pervasive within Sri Lanka which is evident in the recruitment of some grass root level officers, farmer organisation leaders, and at more broader government level. Political affiliations also influence the level and nature of service and benefits farm households receive from officers and the government programmes implemented by those officers. Government officers intervene to support households during shocks.

During the COVID-19 pandemic, farm households were exposed to multiple and diverse sets of shocks, consisting of familiar, unfamiliar, predictable, and unpredictable sets of events. For example, extreme climatic events such as heavy rains or prolonged droughts were familiar to farm households, but the time they occurred was unpredictable. There were some diseases in vegetables that were familiar, and their occurrence was predictable depending on the environmental conditions and growth stage of vegetables. There was a change in government policy on agrochemical imports during this period. Although government changing policies is not unusual or unfamiliar, the export ban on agrochemicals was unpredicted and the impact was unfamiliar. The COVID-19 pandemic was unfamiliar, and not predicted.

Farm households faced a mix of shocks over a period during the pandemic. The mix of shocks experienced by farm households during the pandemic included some that were inter-related,

consecutive, cumulative and ongoing shocks. The shocks experienced by farm households during the pandemic was related to loss of markets, lack of access to inputs, loss of employments, restrictions in travel, changes in government policy and these shocks were finally translated into a financial impact on households. The impact of the shocks during the pandemic was not only at the household level but also on the broader national and international level, which ultimately affected the household level.

6.3 The nature of shocks on smallholder households

Over any period, smallholder farmers are likely to be experiencing multiple and varied shocks. Over the COVID-19 pandemic smallholder farmers experienced multiple and varied shocks that were interconnected, consecutive, continuous and ongoing. The impact of a single shock on a single or multiple households at a given point in time has been the focus of many studies (Abdulaleem et al., 2023; Fafchamps et al., 1998; Hussain et al., 2020; Quandt, 2021), this study sheds light on the actual experiences of households and how they navigate multiple and diverse shocks. The presence of one or two additional shocks during the pandemic was identified by several scholars in different developing country contexts (Bhowmik et al., 2021; Race et al., 2023; Rahman et al., 2017; Xu et al., 2021). This study extends literature on multiple shocks faced by households during the pandemic and the broader literature on shocks.

6.4 The impacts of shocks and farm household responses

This study highlights that for smallholder vegetable farmers, shocks, the impact of shocks, and coping strategies are interconnected, as is illustrated in Figure 6.2 and not isolated as simple cause-effect relationship between shocks impacts and coping strategies as was described by some scholars (Bahta & Musara, 2023; Okamoto, 2011; Quandt, 2021).

This study investigated the impact of shocks and the nature of coping strategies at the household level, as has been done by other scholars (Haq, 2015; Rashid et al., 2006; Wulandari et al., 2022). Shocks

were investigated within and across households in two case sites with different scales, where the shocks were cumulative, consecutive, continuous, and ongoing.

The types of coping strategies developed by farm households when experiencing shocks were similar across the households. But, it varied across the households depending on the time, the household circumstances and the nature of the shocks. Some of these strategies were started short term and remained short term while some were adopted as long-term strategies when such strategies provided consistent support for the farmers as has been reported by some scholars (Quandt, 2021).

This study shows coping strategies used by households were shown to be similar across the context (e.g. Vietnam, India, Bangladesh) (Pradhan & Mukherjee, 2018; Rashid et al., 2006; Tran, 2015) and the different types of shocks (e.g. drought, pandemic) they experience (Hussain et al., 2020; Quandt, 2021). These strategies includes livelihood diversification, financial strategies (e.g. borrowing, selling assets, use of savings, reduction of consumption), production strategies (e.g. changes in inputs, changes in crop types), marketing strategies (e.g. selling method, change in the amount sold, reducing price).

The impact of shocks smallholders experienced was not linked to where farm households lived, for example, whether in Kandy or in Nuwaraeliya or in a rural or urban area. Instead, the differences in the impact were evident at the farm household level which included several factors such as reliance on vegetables as an income source, scale of production, access to markets, access to social relationships and availability of financial capital. For example, the commercialised farm households that produced vegetables on a comparatively large scale were hard hit by the market closure because they did not have alternative markets compared to subsistence farm households that produced at a comparatively small scale. This is similar to the findings of Tripathi et al. (2021), that highlighted large-scale farmers in South Africa were more impacted due to export market breakdown during the pandemic than their small-scale counterparts.

The ability of smallholders to cope with multiple shocks depends on the household circumstances, including their financial situation, at the beginning of the period of shocks. Relatively wealthy farm households tended to cope better at the beginning of the pandemic compared to less wealthy farm households as has been also highlighted in South Africa in the work of Tripathi et al (2021).

This study also supports the idea that capital contributes to household resilience during shocks, as argued by other scholars (Adimassu & Kessler, 2016; Yang et al., 2021). In the context of vegetable smallholders in Sri Lanka, it is not one type of capital but the combination of financial and social capital at the household level that supports household's ability to cope. Several studies also acknowledge the complementarity of these household capitals (Paumgarten et al., 2020b; Yang et al., 2021) and this study enriches that literature with evidence from vegetable smallholders in Sri Lanka.

The impact of shocks on different households varied. All households in the study were impacted financially by the set of shocks they experienced. However, the significance of the financial impact on the livelihoods and well-being of farm households varied depending on their livelihoods, types and scale of vegetables produced, and types and mix of vegetable markets. Most subsistence farm households produced and sold less vegetables compared to the comparatively large-scale farm households. During market disruptions, developing strategies to sell a higher volume of vegetables was challenging and resulted in a significant financial impact for comparatively large-scale farm households who were highly dependent on vegetables for their livelihood. The pandemic impacted farm households differently due to the diversity in vegetable volume produced among the farm households and the relative reliance of the household on vegetables. Other studies in developing countries have reported that smallholders produced vegetables which are perishables were adversely affected by the pandemic (Alam & Khatun, 2021; Kumar et al., 2023; Middendorf et al., 2022) because of the disruptions in accessing inputs and markets, loss of yield and income, difficulties in transportation, and increase in post-harvest losses.; however, this study enriches this work by

highlighting in depth the strategies used by different vegetable farm households and the factors that influenced those strategies.

Although some scholars explained the relationship between the commercialisation level and impacts of shocks, the literature on the pandemic impact in developing countries highlights that the pandemic adversely impacted smallholders, without differentiating across heterogeneity among farm households (Adhikari et al., 2021; Gregorioa & Ancog, 2020; Guido et al., 2020; Tripathi et al., 2021). In contrast, this study explored the impacts on diverse farm households from subsistence through to relatively commercialized, from relatively poor through to relatively wealthier, and from rural through to urban farm households. The heterogeneity of farm households in terms of their household circumstances, household resources, and coping strategies were also well acknowledged in this study.

Farm households who predominantly depended on income from vegetables were affected to a greater extent financially compared to subsistence farm households who did not primarily rely on income from vegetable selling. However, subsistence farm households who did not primarily depend on income from vegetable selling were still hard hit financially during this period as they also lost off-farm income sources and any loss of income was potentially significant for those households. Income loss due to loss of off-farm jobs during the pandemic was evident in other studies (Adhikari et al., 2021; Kumar et al., 2021). This study also showed that relatively well-off farm households were not necessarily buffered from the impact of the shocks compared to less well-off farm households.

There was a difference in the impact of the pandemic on farm households depending on the types and mix of vegetables grown and types of markets they sold into. Some farm households cultivated only specialised vegetables while others cultivated a mix of specialised vegetables and non-specialised vegetables. Farm households in this study sold vegetables to the tourism and hospitality sector and local food sector markets. The tourism and hospitality sector markets relied on exports, international and local tourists who stayed in hotels and restaurants, whereas local food sector markets relied on local customers who purchased vegetables from retail markets, wholesale markets and supermarkets.

Farm households who only grew specialised vegetables (e.g. spices, herbs) for specialised markets for which there is no alternative market, suffered when those specialised markets failed. Farm households who grew a mix of vegetables; specialised vegetables and non-specialised vegetables, were not as badly affected because they had alternative markets for non-specialised products.

There tended to be a significant impact on farm households that sold their produce to the markets that relied on exports or tourism and hospitality trade compared to those that relied on local food sector markets. The farm households in urban areas tended to be relatively well-off, but the impact of the pandemic on their income was significant. Because they solely relied on specialised markets linked to tourism and hospitality compared to subsistence farm households who relied on a mix of markets including the local food sector markets.

Those farm households who only sold products to export or to the tourism and hospitality trade for which there was no alternative local market were particularly adversely impacted financially. This reflects what other scholars have reported. For example, in Vietnam, aquaculture farmers who sold *pangasius*[2] products to export traders were more severely impacted by price drops than those selling their products to local traders or other buyers (Ton Nu Hai & Speelman, 2023). Tripathi et al (2021) also found that farm households in South Africa who depended on export markets were badly affected due to the breakdown of export market. In Vietnam, South Africa and Sri Lanka, those producers who relied on a single market, that was not a local market, were adversely affected by the pandemic. As this research shows, in the Sri Lankan context, it was not only those farm households reliant on exports, it was also those farm households reliant on the tourism and hospitality sector and those who supplied to the distant markets that required the produce to be transported that were impacted, also. Ton & Speelman (2023) and Tripathi (2021), however, have only mentioned about the export sector without mentioning about trade linked to tourism and hospitality or alternative markets.

Farm households used a dynamic range of strategies to respond to the shocks. As Figure 6.1 demonstrates, farm households often utilized a combination of strategies targeting production (e.g.,

using alternative inputs), marketing (e.g., exploring new markets), and financial hardships (e.g., seeking loans). There was no consistency across households as specific types of strategies were used by a particular group of farm households. Instead, there was a mix of strategies used by households reflecting their household capitals including their social and human capital and member characteristics, the type, scale and mix of vegetables, farm production and marketing systems, households' reliance on vegetables as an income source and livelihood activities. However, since the main impact was financial all the strategies used by farm households included financial hardship strategies and strategies to maintain or buffer the household income and to reduce the costs (Figure 6.1). Financial hardship strategies mainly included borrowing, followed by other strategies such as the use of savings, selling assets, reducing consumption, relying on loan extension, giving up cultivation on leased lands and relying on non-credit financial support from household members. These strategies were meant to secure the financial status and cover the expenses in the household, including the expenses for vegetable production. The number of strategies to buffer the income was higher than that of strategies to minimise costs, as shown in Figure 6.1. However, certain strategies such as using alternative inputs, collective purchasing of inputs and collective marketing of vegetables were meant for both purposes: to buffer the income and to minimise the costs.

These strategies were not necessarily only related to vegetables but also related to other crops and livelihood activities. What differed was when households used those strategies and which strategies they began with, depending on their financial circumstances at the start of the pandemic. How households used financial hardships strategies also varied depending on their social networks and access to collateral.

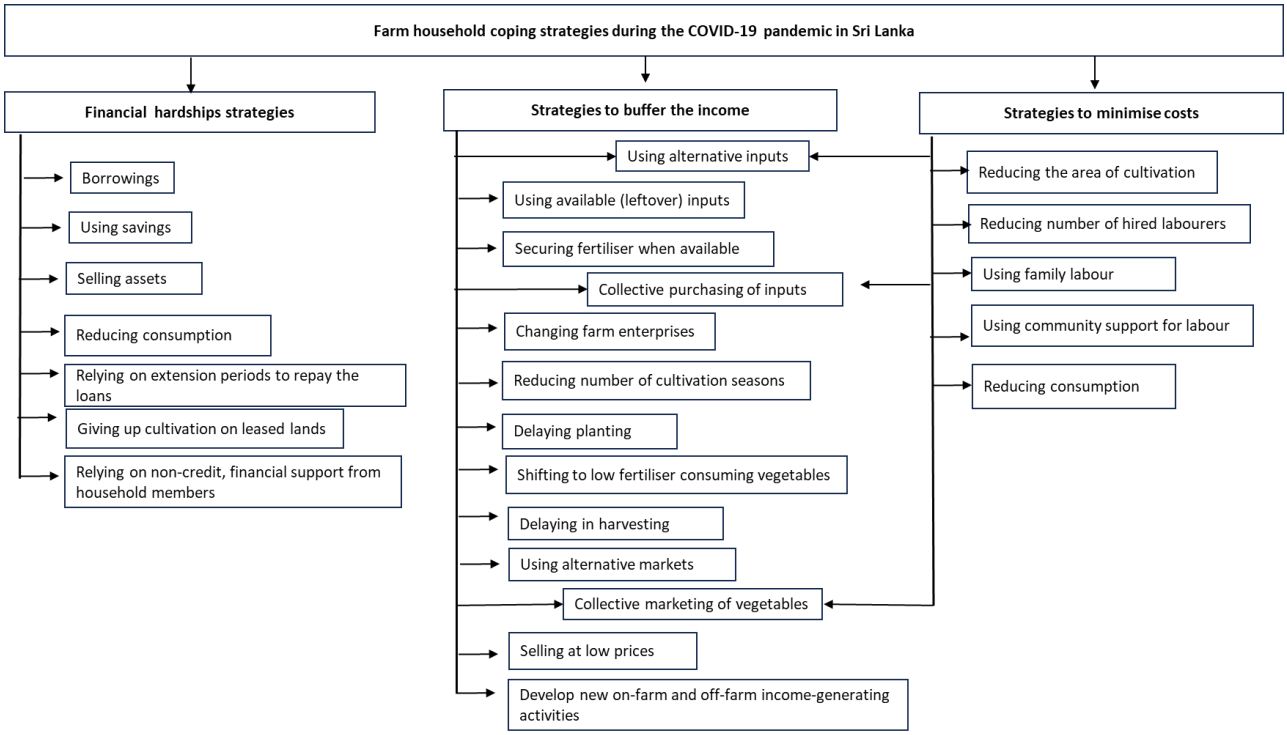

Figure 6-1.Farm household coping strategies during the COVID-19 pandemic in Sri Lanka

The ability of farm households to buffer the impacts of shocks was linked to the household characteristics and the nature of their social capital. Some farm households who had linking social relationships with government officers were in a better position to access markets by receiving permits to transport vegetables to distant markets during the pandemic. This was not restricted only to farm households living in rural or urban areas. Farm households that had personal relationships with government officers benefited more, as is evident in other countries in the region. For example, in the context of China it was found that access to formal supporting resources after the pandemic was influenced by the personal relationships farm households had with the official departments (Hao et al., 2023).

The impacts of shocks on households, strategies developed by the household and household capital are interrelated and influence each other. But there is no linear cause-effect relationship between impacts, strategies and capital as shown by different scholars (Bhatta & Aggarwal, 2016; Boansi et al., 2023; Yilma et al., 2014). All farm households do not exhibit a consistent level of resilience during the

impacts of shocks. Instead, this study found that the impact of shocks on vegetable farm households in Sri Lanka is linked to household strategies, household capital, livelihood diversification and circumstances before the pandemic in a systemic way (Figure 6.2).

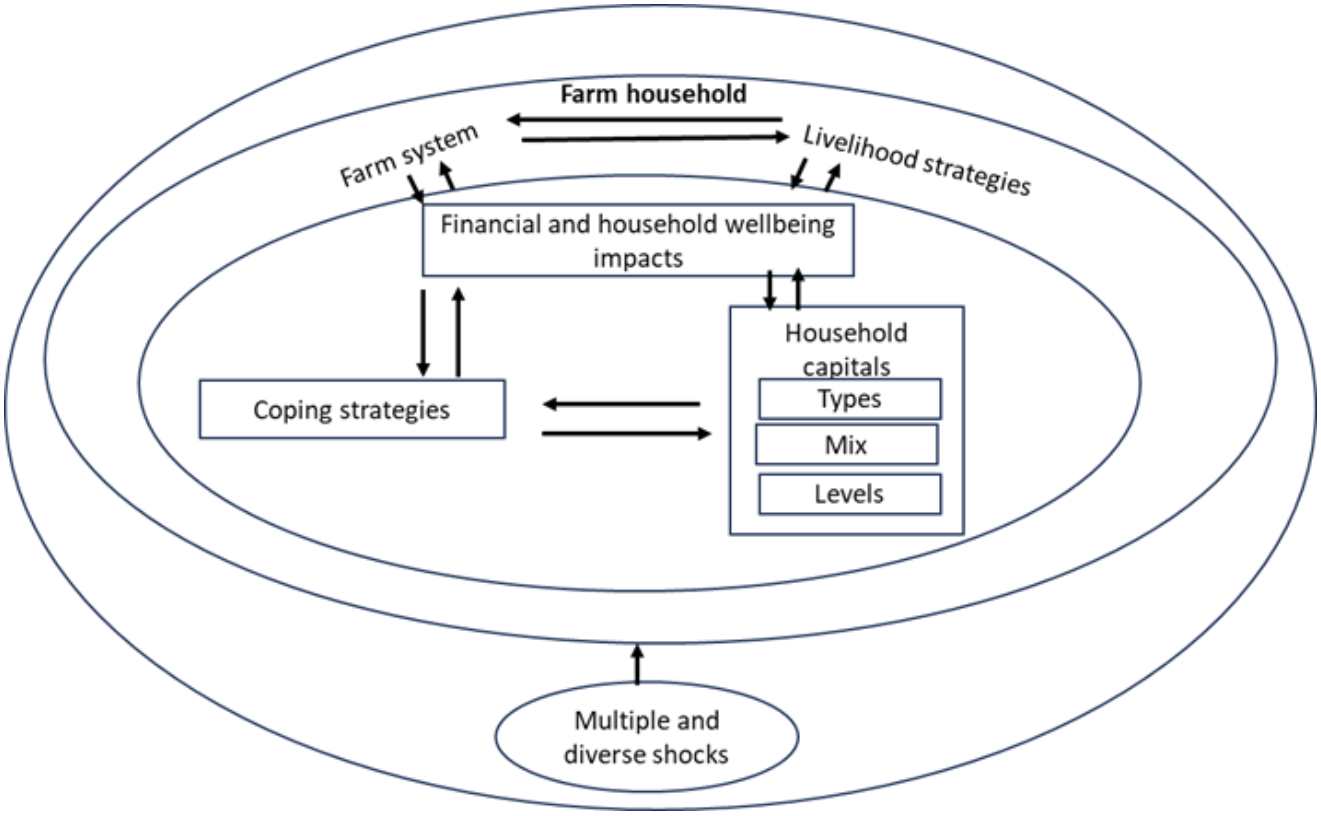

Figure 6-2.A holistic framework to illustrate the impacts of shocks on farm households and their coping strategies

Figure 6.2 illustrates the interconnected nature of impacts, strategies, and household capital during shocks. Farm households, which are partly characterised by their farm systems and livelihood strategies (which include diversification), are affected by multiple and diverse shocks. Farm systems and livelihood strategies are interconnected. For example, conditions at the farm influence crop diversification, while crop diversification influences the farm system. When households are subjected to multiple and diverse shocks, it triggers financial and household wellbeing impacts. These impacts triggered coping strategies; for example, households borrowed (financial hardship strategy) due to the high cost of production (financial impact). On one hand, borrowing depends on levels of the financial

capital available in the household. On the other hand, the extent of borrowing changes the level of financial capital available in the household. The high cost of production affected level of financial capital available in the household. The level of financial capital available in the household affects the high cost of production. Financial impact influenced the farming system and diversification, whereas characteristics of farming systems and diversification reflect the financial impact household experienced. Likewise, over time, the more households are forced to borrow, the more it affects the household capital. This is linked to the financial capital households had at the beginning of the pandemic. The households that didn't need to borrow at the beginning did eventually borrow and some households who already borrowed continued to borrow and it eroded overall household capital.

Impacts of shocks influenced strategies developed by households. The impact of shocks on households was predominantly financial, and specifics of the financial impact on households were varied. For some, a part of the financial impact was linked to decreasing income and increased cost of labour. There were households who heavily relied on hired labour before the pandemic, and they used one or a mix of three strategies; reducing hired labour, reducing land area cultivated and substituting family labour. The response of some was to use family labour where possible. For example, farm households that did not have adequate household capital in terms of family labour reduced the land area cultivated, whereas some who had sufficient family labour used that to fulfil the labour requirement. The use of family labour to fulfil the labour requirement during shocks was also evident in other developing countries including India (Baba et al., 2011; Goswami et al., 2021; Satishkumar & Umesh, 2018) and Ethiopia (Adimassu & Kessler, 2016).

Livelihood diversification has been identified as a sustainable livelihood strategy (Marschke & Berkes, 2006; Scoones, 1998b). Across all households in this study there were different types of diversification including of income source, livelihood activity, farm enterprises and markets. In this study there was no apparent link between the scale of production or scale of marketing and the level of diversification of farm households. For example, subsistence farm households were not less or more diversified

compared to market-oriented farm households. During the pandemic, livelihood diversification became a coping strategy for some farm households. Some households diversified livelihoods by growing different crops to seek new markets whereas some shifted to new off-farm income sources. The nature of diversified activities reflected the opportunities available for them to diversify including what household capitals they had access to, climate, and government policy.

Farm households who were diversified by growing multiple crops, and accessing multiple markets were able to buffer some of the impacts when one crop or one market failed. For example, households with mixed on-farm enterprises, such as cultivating vegetables and rearing dairy cows, could buffer the income loss from the lack of vegetable sales during the pandemic by selling milk locally. Farm households who sold their vegetables to local food sector markets could also buffer the impact of shocks compared to the household members who sold only to one specialised market that was not local.

The benefits of diversification, as advocated in the SLF, are supported by this research. However, livelihood diversification did not guarantee that farm households were more able to buffer the impact of the shocks experienced during the pandemic when the income sources that they relied on were linked to markets or workplaces that were impacted by the pandemic. For example, some had on-farm and off-farm income sources, but both were impacted because they relied on the tourism or hospitality sector or people's movement at the domestic level. For example, farm households who were involved in providing transport services through three-wheelers could not continue due to COVID-19-related travel restrictions and fuel scarcity, and the farm households who only sold their produce to tourist hotels could not earn an income due to the tourism breakdown and hotel closure. In contrast, those households who had a member employed by the Government retained their income over this period. Further, if the diversification of farm households included markets and enterprises that were mixed in terms of impacts, those households were in a better position to respond to the impacts. For example, farm households that had dairy cows earned an income by selling milk. It is likely

that the demand for local milk during this period increased because milk powder imports were restricted, and people were buying milk locally. This also reflects scope of the pandemic, extending across global, national and household levels creating a broad-scale impact on multiple aspects of society, industry and commerce. For example, schools, hospitals, transport, business, and tourism were shut during the lockdown period, reflecting the global and national scale of the shocks and the multiple dimensions of impacts associated with them.

Strategies adopted varied across households depending, it appears, on the extent to which the strategy contributed to compensating for the financial impact on the household of the pandemic. For example, some subsistence farm households living in rural areas adopted direct marketing as a way to retain their income from vegetables and compensate for the income they had lost due to market closures. Direct marketing was not a strategy adopted by larger-scale farm households in urban areas. It is likely this is because these producers had no way of selling through direct marketing to neighbours and locals the volume of vegetables they usually sold. In contrast, use of available physical assets as a strategy to sustain the income was consistent across households irrespective of where they lived. For example, some farm households who had accommodation facilities provided accommodation to the hired labour to retain them in the farm during travel restriction period whereas farm households who had a measuring scale used it if they were involved in direct marketing of vegetables.

The strategies used by farm households in response to the financial situation they found themselves were similar. However, when they used these strategies varied depending on their financial circumstances at the beginning of the pandemic. All of farm households borrowed to cope with the financial impact. However, when they borrowed varied depending on their household financial resources and from whom they borrowed varied depending on their social relationships and ability to borrow.

Some farm households developed strategies that differed from others because their circumstances at the time were slightly different. For example, some farm households who had inputs and reserves

utilised those to continue to grow vegetables whereas those who did not have inputs and reserves could not grow vegetables as they did before the pandemic. Some farm households who had physical assets sold these to reduce costs during this period. For example, some who had buses sold those to reduce maintenance cost (e.g. wages for drivers, leasing payments).

6.5 Household capital and farm household coping strategies

The level and mix of household capital influenced the types of strategies farm households employed. Farm households drew on capital available to them to develop strategies during shocks as has been reported by many others (Abid et al., 2020; Bonfrer & Gustafsson-Wright, 2017; Zhao et al., 2023). As household capital varied in type, level and mix, household strategies also varied. Although there was no consistency, there were similarities across farm households in terms of strategies chosen to respond to the financial impacts of the pandemic. Households with relatively low financial capital that were already borrowing continued to borrow. In contrast, the households with financial resources used savings, available resources and then borrowed. Those with relatively low financial, physical and natural capital drew on the capitals they did have, human and social capital, to develop strategies.

Household social capital varied across farm households and the strategies employed drew on this social capital in different ways. The strategies used by the farm households reflected the bonding relationships they had with household members, relatives and friends, bridging social capital reflected the relationships they had with actors related to inputs and markets (e.g. input suppliers, vegetable traders, middlemen) and linking social capital reflected the relationships they had with actors related to government service provision (e.g. extension officers). Subsistence farm households had predominantly bonding and some bridging and linking relationships. Market-oriented farm households living in urban areas in comparison had bonding, bridging, and linking social relationships. Strategies varied reflecting differences in social networks. Subsistence farm households predominantly used their bonding social capital to develop coping strategies. This included collective action by subsistence

farmers, and these strategies were not evident among other farm households who predominantly depended on bridging and linking social capital. Other studies also observed collective action for labour arrangements to acquire inputs and deliver outputs by subsistence farmers after the pandemic (Lopez-Ridaura et al., 2021). For example, a study conducted in Mexico during the pandemic period shows farmers joined together to carry out farm activities for each other as a collective (Lopez-Ridaura et al., 2021). Schwarz et al. (2011) also found that collective action (e.g. participation in voluntary work, co-operation between community members) by households in Solomon Islands during aftermath of 2007 tsunami and earthquake, helped them to cope with the situation.

Market-oriented farm households predominantly used their bridging and linking social capital to develop coping strategies. The types of strategies market-oriented farm households used were to use their bridging and linking networks and relationships to access inputs, markets, and government subsidies and support. The types of strategies farm households adopted varied depending on the type of social capital they had and the role and authority of the people with whom they had a relationship. For example, in this study context, when farm households could not access inputs on time, it was favourable for them to have linking relationships with extension officers or bridging relationships with input suppliers to access inputs, compared to having linking relationships with a school teacher or a medical doctor.

This study showed farm households used their social capital in developing strategies to respond to the impacts of the pandemic , as also shown by others (Chipenda, 2023; Zhao et al., 2023). This study also provides examples as to how different types of social capital influence the strategies used by farm households. For example, borrowing was a strategy used by all eventually and whom they borrowed from varied depending on their financial situation and their networks. Many highlight that smallholders use their social relationships to borrow to cope with financial needs during shocks (Adams et al., 1998; Haq, 2015; Hoddinott et al., 2009). This study shows those households with bonding, bridging, and linking networks tended also to have relatively higher financial capital and

whom they borrowed from tended to differ from those less well-off households with predominantly bonding networks. Those who lived in urban areas tended to be relatively wealthier, more engaged with markets and had linking and bridging capital. They tended to use bridging and linking social capital when they borrowed compared to subsistence farm households who predominantly relied on bonding social capital. This also reflects the differences in financial and social capitals smallholders had living in rural and urban areas as collateral is often a requirement for borrowing in a formal system.

This study shows that subsistence farm households predominantly relied on bonding social capital in developing strategies to respond to the impacts of shocks whereas market-oriented farm households mainly relied on bridging and linking social capital. How different types of social networks were influencing in developing coping strategies is poorly addressed in the available literature through the bonding, bridging and linking relationship lens.

Across households what was evident is that in households that had apparently similar mixes and level of social capital, only some households developed strategies using those capitals. For example, some used direct marketing to sell their vegetables whereas some households with similar mix of resources and opportunities did not use that strategy. This may reflect other circumstances that the researcher is not aware of or the personal characteristics of some individuals within such households that led to direct marketing and use of household capital in that way. As also shown by others (Manlosa et al., 2019; Thulstrup, 2015), this study acknowledges that characteristics of individuals related to their skills, experience, knowledge, and health serve as important elements of human capital. For example, farm households who had skills, knowledge, and experience in preparing alternative fertilisers to chemical fertilisers were able to continue vegetable production during the fertiliser scarcity. In addition, findings of this study suggests that individual differences within a household, for example intrinsic motivation and enthusiasm of some individuals, enabled them to develop strategies. These individual characteristics are components of human capital on which some households capitalised to respond to the impacts of shocks.

Strategies developed by farm households likewise reflected the physical and human capital of the household. However, physical capital alone did not enable the development of strategies unless it was associated with intrinsic motivation or enthusiasm of household members to utilise those physical resources to sustain or earn an income. For example, some farm households who had a measuring scale used those to weigh vegetables during direct marketing. In this case, availability of a measuring scale alone did not result in developing a strategy of direct marketing unless some household members possessed intrinsic motivation to shift to direct marketing and capitalised on their available physical capital. This also shows one or few individuals' actions within the households can shape the coping strategies households use to respond to shocks and these individual characteristics can be incorporated into human capitals in SLF. The significance of individual characteristics in shaping coping strategies is also shown by Chen et al. (2020). In this study it was identified that in China, villagers in two villages with similar characteristics, responded in different ways to the changes occurring with tourism development. Some villagers in one village who had aspirations and entrepreneurial attitudes started up new businesses for tourism development while the villagers in the other village did not develop such strategies (Chen et al., 2020).

There was no evidence that financial and social capital leads to a particular set of strategies or financial and human capital leads to another set of strategies. Strategies used varied across households reflecting the overall household circumstances. Therefore, having one particular kind of social or physical capital was not necessarily helpful in developing strategies because it varied across households.

Access to a diversity of type, level and mix, of household capital influenced the strategies households use. The strategies also reflect the impacts of shocks households experienced. The impact was likewise linked to the overall household circumstances which also included types, levels and mix of household capitals, livelihood strategies (and other elements illustrated in Figure 6.2) and the overall situation farm households were in when the pandemic started. For example, some farm households who had

diversified income sources appeared to buffer the impact compared to others who were not diversified at all.

6.6 Dynamics of farm household coping strategies

Developing coping strategies to respond to the impacts of shocks may reflect the geographical location of these farm households as shown by some scholars in other contexts (Zhang & Hu, 2021; Zhao et al., 2023). However, this study shows it is not only related to where farm households live but also their social networks.

Farm households developed different strategies over time as their circumstances, and opportunities that existed to them, changed. The households with financial capital in the form of savings and liquid assets started using their savings to cover costs. This was followed by reducing inputs and food consumption, borrowing, using alternative inputs or reducing costs. The households with relatively low levels of financial capital started by reducing inputs and food consumption, followed by borrowing. Farm households who did not borrow at the beginning tended to borrow later because their savings and financial resources were depleted over time. Farm households who had leftover inputs used those at the beginning, but later, when their resources were depleted, they reduced the input use. This changing situation was created by the impacts of multiple and diverse shocks occurring over an extended period of time. Many scholars undertake a single snap-shot in time analysis to capture the response of households during shocks (Chipenda, 2023; Haq, 2015; Heltberg & Lund, 2009), but this study demonstrates that farm households developed different strategies depending on the nature of their capitals and circumstances at different points of shocks during the pandemic period.

Farm households chose non-erosive strategies first if they were able to, before moving to erosive strategies. Farm households were more likely to adopt erosive strategies once household resources were depleted. Adopting erosive strategies depended on farm household circumstances, which changed with the pandemic. For example, some were already borrowing due to their financial

situation, while the need to borrow for others emerged later after their existing resources were depleted. Ultimately, all the households reached a point where they adopted erosive strategies because of the impact of the shocks on the household over time. The household situation at the onset of the pandemic, the length of time shocks were experienced, and the cumulative impact of the shocks influenced whether and when farm households moved from non-erosive to erosive strategies.

Relatively poor households will tend to use erosive strategies sooner compared to less poor households. But what this study highlights is that over an extended period of ongoing shocks like the pandemic the majority of smallholders are likely to face the need to use erosive strategies. The resilience of not only individual households but the resilience of communities is then put at risk and the ability to recover compromised.

In this study, all farm households developed short-term coping strategies to buffer the impacts of the pandemic shock as evident in other studies (Menon & Schmidt-Vogt, 2022; Yegbemey et al., 2021). However, some of the short-term coping strategies became long-term livelihood strategies (e.g. direct marketing of vegetables) and it highlights how shocks can be a catalyst for long term livelihood changes. These strategies were not erosive and were often adopted by households who had household capitals which enabled them to develop those strategies. In contrast, over time, some coping strategies became erosive (e.g., continuing borrowing and having difficulties in repaying). Therefore, this study illustrates that, pre-existing livelihood strategies help some households to buffer the impacts of shocks. In contrast, for others, coping strategies developed as a response to the impacts of shocks may be adapted as livelihood strategies for the longer term.

Several opportunities arose with the pandemic, which some farm households capitalised on. The government policy on the turmeric import ban was used as an opportunity by the vegetable farm households cultivating turmeric. Because of the high market demand, those farm households intensified their turmeric cultivation and earned an enhanced income. The situation created after the government policy on the turmeric import ban due to lack of foreign currency provided an opportunity

for some to take advantage of a pre-existing livelihood strategy. Households with bridging and linking social relationships with input suppliers and government officials respectively, capitalised on the situation to acquire inputs and access markets.

6.7 Relevant government interventions during the pandemic

Playing a patriarchal role in the farming community in Sri Lanka, the government continued to provide different kinds of support programmes for farmers during this period. Supporting input supply, introducing a new vegetable purchasing programme through DS offices, issuing travel permits, continuing extension services, providing direct financial support, and continuing general poverty alleviation programmes were some of the government interventions. Issuing travel permits helped some farm households to market their produce.

However, as is evident in this study, government programs that facilitate input supply and provide alternative marketing channels during this period, are likely to reach a limited number of smallholders when access is defined by the volume produced and the relationships farmers have with middlemen.

In a broad-scale series of diverse shocks like what occurred in the pandemic, government support for farmers is also compromised. For example, government organisations, that mainly relied on the private sector for inputs, struggled to procure inputs and meet farmer needs when the supply chain broke and an economic crisis emerged. This ultimately impacted farm households. Similarly, the vegetable purchasing programme initiated by the government likely did not provide the smallholders with any special advantages as it involved the same kind of middleman farmers with whom farmers dealt during the pre-pandemic period.

The level of government intervention in input and vegetable prices during this period was likely less effective in catering to farmer needs. Private sector input suppliers sold inputs at very high prices, and government control over input prices or vegetable selling prices was minimal, as shown in this study.

Therefore, this evidence indicates mixed results of government programmes for farm households during the pandemic, as evident in India (Kumar et al., 2021).

6.8 Conclusion

This chapter discussed the main findings of this study and its contributions to the literature. The farm households in this study were hugely diverse in terms of their household capitals, livelihood strategies, vegetable production and marketing system and individual characteristics as reflected in their strategies. Vegetable farm households in Sri Lanka were exposed to multiple and diverse shocks and they responded to the impacts of the pandemic and other shocks during this period by implementing strategies in different ways. Some households used similar strategies to respond to the impacts of shocks on their household, while some used similar strategies but implemented in different ways.

It was identified the predominant impact of the shocks on households was financial. However, the nature of the impact of the pandemic on farm households cannot be viewed solely in terms of absolute loss of income or absolute increase in costs. It also depends on the relative impact on household circumstances which includes types, levels and mix, of household capitals, livelihood strategies, vegetable production and marketing system and also where households started when the pandemic started. Therefore, the pandemic had unpredictable and surprising implications for households.

Some of the relatively wealthier and well-connected farm households were financially impacted to a much greater extent than subsistence farm households who appeared to be poorer and less connected to markets. It is therefore not solely the nature of the impact on households, but the circumstances farm households find themselves in as a consequence of shocks that is reflected in the coping strategies developed by households during shocks. The more vulnerable farm households had less options to buffer the impact of the pandemic than other farm households. Although the financial impact on these households may have been small compared to wealthier and less vulnerable

households, the situation more vulnerable farm households found themselves in as a result of pandemic was likely much worse than for other households.

The sequence of strategies used by households varied over time. Some pre-existing livelihood strategies such as diversification were helpful for some households to buffer the impacts, but there was no guarantee that diversification buffered the impact all the times. However, diversification of markets appeared to be a viable option for farm households to buffer the impacts of shocks such as pandemic, which resulted in broad scale impacts across global, national and household levels.

The next chapter will make key conclusions based on the main findings discussed in this chapter.

7) CONCLUSIONS

7.1 Introduction

Improving agricultural productivity and the livelihood of farmers has been a predominant focal area in the agricultural development and policy agenda in Sri Lanka. However, like many other developing countries, farm households in Sri Lanka are continuously susceptible to various shocks which ultimately impact different aspects of their livelihoods. The novel and unexpected COVID-19 pandemic brought an unprecedent shock to these farm households, impacting them differently. This research was conducted to answer the following research questions: How did Sri Lankan vegetable farm households respond to the impacts of the COVID-19 pandemic, and why?. The key findings of this will be helpful for policymakers and development practitioners of the agricultural sector in designing interventions to uplift the ability of vegetables and other smallholders to respond to the impacts of shocks. This study explored the impacts of shocks on vegetable farm households and their responses holistically and obtained an in-depth understanding of the circumstances at the household level. The key findings illustrate that the vegetable farm households in the study area were differentially impacted by shocks during this period. However, the dominant impact for all households was financial. The responses of farm households reflect the nature of the impacts on households, household capitals, livelihood strategies, vegetable production and marketing system, climate, government policies and overall household circumstances. This chapter will begin with key conclusions and theoretical contributions, followed by practical implications and suggestions for future research.

7.2 Key conclusions

This section highlights key conclusions drawn from this study. This section also highlights how the main conclusions contribute to the literature on impacts of shocks on households and their coping strategies.

The predominant impact on vegetable farm households was financial.

All farm households experienced shocks of different types, levels and mixes during this period due to the inability to travel, difficulties in accessing inputs, market and business closure, and loss of employment. Although these shocks differently impacted farm households, the predominant impact on farm households identified by participants during this period was financial in terms of decreased income and increased costs. When farm households who are reliant on selling their products and using purchased inputs to grow their products are exposed to broad-scale shocks which disrupt markets and access to inputs, those shocks will have an impact on farm household income and cost. If broad scale shocks on households continue, an ultimate outcome on the household will be financial.

Level of diversification influenced the impact of shocks on farm households. Farm households with diversified production systems and income sources were less likely to be as badly affected as those with less diversified production systems and income sources.

Household coping strategies were diverse and dynamic.

At any point in time different strategies were being used by farm households to respond the situation they experienced. Overtime those strategies used by farm households changed as their situation also changed. These strategies reflected types, levels and mix of household capitals, livelihood strategies, the nature of impacts and household circumstances at the start of the pandemic. As illustrated in Figure 6.1.in the Discussion chapter, farm households use a mix of strategies related to production (e.g. using alternative inputs), marketing (e.g. using alternative markets) and financial resources (e.g. borrowing). These strategies were associated with buffering the income, minimising the costs and buffering the financial hardships on households, respectively. However, there was no consistent mix of strategies only used by one particular group of households. This means during a wide-scale shock with widespread impact, farm households with various circumstances might use the same strategy but in

different times, depending on their resources, production and marketing systems, and opportunities available to them.

This study supports the idea that diversification is a sustainable livelihood strategy that helps farm households cope with shocks. However, during an extended period with multiple and diverse shocks, diversification may not guarantee farm households' ability to buffer the impact of shocks when the impacts are widespread, linked to different socio-economic sectors and not limited to single production or marketing system.

A household will use various strategies over time if they experience shocks for an unusually extended period. However, those who are relatively less well-off tend to resort to erosive strategies earlier than those less vulnerable. Those less vulnerable tend to have more options to avoid erosive strategies (e.g. selling household resources) initially.

Coping strategies used by households can become livelihood strategies for some when they are not erosive, and circumstances remain favourable for those strategies as livelihood strategies. Based on this research these circumstances include types and mix of household capital and favourable government policies.

Choice of strategies were influenced by the degree and nature of the loss. Some households used certain strategies because those strategies buffered the loss experienced due to shocks, whereas others did not use such strategies because they did not compensate for the loss. For example, relatively poorer farm households who earned relatively lesser income from selling vegetables could do direct marketing, which helped them sustain household income. In contrast, relatively large-scale farm households did not practice direct marketing as it is assumed it could not compensate for the income loss they experienced due to market closure. Direct marketing was practical for the subsistence farm households who produced a lesser volume compared to relatively commercialised farm households who produced a higher volume of vegetables.

Consistent with other literature relatively poorer farm households tended to have less strategies to choose from (Skoufias, 2003), whereas those who were better-off tended to choose from more strategies as they had more household resources and social relationships which enabled them to access inputs. For example, compared to relatively poor farm households, relatively better-off farm households had more savings and financial resources to cope with the financial impact and some of them were able to acquire inputs relying on their bridging and linking social relationships.

Market diversification helps during broad-scale shocks

Specialising in perishable food crops restricted to only a specialised market relying on exports and arrival of international tourists is risky compared to producing perishable food crops for which local markets exist. Therefore, when shocks are broad scale and disrupt export and international markets, farm households who have diversified markets including local markets are likely to be more able to buffer the impact compared to those who solely rely on exports or international markets. Providing vegetables to local markets was feasible due to comparatively easy access amidst travel restrictions and fuel shortage. If products are sold to the local markets, it is less likely to be impacted by the wide scale market disruptions and this also highlights the resilience at the local level during shocks.

A mix of household capital supports farm households during shocks.

Coping strategies used by farm households reflect the types, mix and level of social, human, physical, natural and financial capital they have. Farm households had varied social networks with some with relatively weak bridging and linking networks. Although households experiencing financial impact may over time use similar strategies, how the strategies implements are likely to reflect differences in social capital across households. For example, in this research, the majority of households ended up borrowing; however, who they borrowed from under what terms reflected the strength of linking and

bridging networks of households. Poorer households with predominantly bonding networks drew on these relationships for credit, whereas other more well-off households utilised more formal lending avenues through linking and bridging networks.

As reflected in some of the strategies associated with farm household social capital (e.g. use of collective purchasing to acquire inputs during travel restrictions) this study also highlights the importance of collective resilience to buffer the impacts of wide- scale shocks which extended over a period of time.

Human capital in SLF generally covers socio-demographic characteristics such as age, gender, education level and health status of household members. This research highlights that personal attributes of individuals in a household (e.g. motivation, enthusiasm) can also contribute to developing specific strategies and argues for including personal characteristics of household members in the human capital in SLF. Resilience at the household level is shown to depend, in part, on the individual characteristics of household members that can help farm households to buffer the impacts of wide-scale shocks.

Nature of shocks on farm households.

The findings of this study conclude that, in general, at any point in time farm households experience multiple and diverse shocks. Over time these shocks can be cumulative, interrelated, consecutive, and ongoing. Studies that consider households and the multiple shocks they are experiencing rather than focusing only on one type of shock will better capture the complexity of the circumstances and impacts of shocks on households. Concentrating on one shock at any point in time will not provide comprehensive understanding as it is highly unlikely that only a single shock exists at one point in time. Instead, it is likely that multiple shocks co-occur as shown by in this study.

Although the COVID 19 pandemic was identified as a health shock it ultimately translated into a financial shock for smallholder households because of the measures employed to minimise the health shock and its ultimate effects nationally and internationally. Widespread global shocks, like COVID-19 (and the global financial crisis) are illustrated and confirmed as translating into many diverse inter-related shocks that go beyond simply health or money as is illustrated in this research. However, ultimately when the result is impacted access to markets, inputs and credit, over time most smallholder households are likely to be impacted, particularly if they engage in commercialised agriculture.

7.3 Theoretical contributions

Smallholders do not experience single shocks in isolation, rather they face multiple and diverse shocks to which they develop a range of interlinked coping strategies given the resources they have available to them as a household. Multiple and diverse shocks can be interconnected, consecutive and cumulative. At any point in time coping strategies used reflect household resources and the cumulative impact of shocks. When smallholder farmers experience shocks for a period of time, their coping strategies change, and they increasingly rely on erosive strategies.

Strategies chosen in response to short-term shocks can be adopted as long-term when those strategies provides consistent support for farmers. Coping strategies used by smallholders are similar and it includes livelihood diversification, financial, production related and marketing related strategies.

When the impact of shocks affects the financial situation of the household, the strategies smallholders use will depend on the financial status of the household prior to the shock. Ultimately, if households are dependent on income sources impacted by shocks directly and indirectly, the significant impact on the household will be financial. Coping strategies, therefore, will tend to focus on responding to that financial situation.

The mix of coping strategies smallholder farmers experiencing multiple and diverse shocks utilise when the impact of the shocks is primarily financial and linked to loss of market access depends on four factors: the household financial situation, the nature and level of bonding and bridging social networks, the innovativeness of household members and access to alternative markets.

As many scholars have argued, this study also acknowledged that the COVID-19 pandemic was a health shock. However, it also showed that this health shock became a financial shock for smallholders in Sri Lanka over time. This contributes to the literature which found the same among households in different contexts, for examples in Uganda (Mahmud & Riley, 2021), in China (Liu et al., 2021) and in India (Kumar et al., 2023). Further, this study identified decreased income and increased costs during this period as the main reasons for the financial impact.

Similar to other studies, this study also found that smallholders develop strategies to respond to shocks (Dercon, 2002; Quandt, 2021; Rashid et al., 2006). This study enriches this literature by demonstrating that in the context of smallholders in Sri Lanka, the composition of strategies varied depending on four factors; the financial situation at the beginning of the pandemic, nature and level of bonding and bridging and linking social relationships, types of output markets and innovativeness of household members.

Smallholders' coping strategies in Sri Lanka varied over time as circumstances changed. However, ultimately, all the households had fewer options to cope with. This study's evidence showed that short-term coping strategies can evolve into long-term strategies when they prove consistently valuable. This contributes to the findings of Quandat (2021) in the context of Kenya.

This study also argues the value of including individual household members' innovativeness as a component of human capital in SLA.

7.4 Practical Implications

Understanding the impacts of shocks requires considering the household level and their circumstances during shocks. This study argues, while supporting the work of Morton (2007), the need to consider the diversity of smallholders across production systems, livelihood activities and impacts of shocks in understanding their circumstances and their ability to buffer the impacts of shocks. The impacts of shocks cannot be understood by simply focusing on types of shocks and assuming particular impacts when the households, their production systems and household circumstances are diverse. This also means that it is not always only the poorest of the poor affected by the shock impacts.

Policies and interventions intended to support farm households during shocks, like in the pandemic, need to be focused on the poorest as they are less able to buffer the impacts of shocks. However, these policies should not disregard the other farm households who may not be poor but who may be adversely affected and whose failure may have a broader scale impact on poorer farm households. For example, there were relatively poor farm households who earn income by providing seasonal labour to relatively wealthier farm households who cultivated vegetables in large scale. These labour opportunities for poorer farm households were lost due to the adverse impacts on relatively large-scale farm households during the pandemic.

Interventions should be focused on building resilience within farm households, and local community rather than relying on government assistance in a context where there is a lack of equity in access to government support systems. This can be done by for example by promoting more 'self-help' groups, as evident in some of the collectives already established (i.e. *Sithamu* women's society) in the Kandy district. Further, maintaining seed stocks at the household level and supporting the work of farmer organisations, which were disturbed due to policy changes during this period, will be important to build resilience at the household and community levels.

Developing coping strategies by households sometimes takes time. The circumstances and needs of households change over time depending on how long shocks continue. Therefore, interventions should

be available over time and be able to respond to the changing needs of the households. The interventions should recognise that households who do not need support at present may later, while households who need support at present will need continuing and potentially different support later.

Given that the overall outcome on farm households was financial, providing direct financial support and increasing access to credit at low interest rates will support farm households. However, it should be acknowledged that not all farm households access banks for credit. Therefore, there should be different financial services and programmes to acknowledge varying circumstances and sources of borrowing by farm households. Restructuring the current banking systems to make them convenient and user-friendly and revisiting different arrangements in borrowings, interest rates and repayment to reflect the varied needs and abilities of farm households will help them cope with the financial crisis that might occur during shocks.

Given the sensitivity of input supply for agricultural production and the government sector's lack of capacity to meet the full requirement of inputs at present, continuous collaboration between the government and private sector is needed to ensure continuous input supply during shocks. On one hand, the private sector input suppliers have more capacity to cater to farmer needs than the government input suppliers. On the other hand, the government sector has a governing role during shocks. Therefore, collaborating will ensure continuous input supply to farmers during shocks. This will also ensure more government intervention in input prices during input supply breakdown. Because this study showed that private sector input providers sold inputs at very high prices, and there was little government intervention to control the input prices.

Improving marketing infrastructure to establish new and multiple vegetable markets will provide more avenues for farmers to sell their produce during shocks. This will enhance the options available for farmers and help increase farm income.

The new cash support programmes, vegetable marketing programmes introduced during the disturbances required to be transparent and unbiased. Careful monitoring of such programmes will ensure that farmers are actually benefited.

Improving the use of new technologies in agricultural extension services will make farmers remain connected to the extension officers during disruptions.

7.5 Reflections on the research design

Following a holistic approach in this study enabled the researcher to illustrate the multiplicity of shocks and the interconnectedness of their impacts on households. It also helped to demonstrate the diversity of experiences across farm households.

This study relied on one or two members from each household to present the household perspective. This might have made the results slightly biased in favour of interviewed household members. If this study collected data from all the household members across age groups, gender and education level, the results might be different. For example, the impacts of shocks and responses of the school children in the household may be different from the impacts and response of parents.

Collecting data on various stakeholders linked to vegetable production and marketing, such as bankers, input suppliers, and marketers, could have provided more insights into some of the other dynamics related to the impacts on farm households and their coping strategies.

Data collection in this research had to be carried out considering the COVID-19-related travel restrictions, social distancing measures, and fuel scarcity prevailing in the country then. Interviews were the primary data collection method used, and this meant some interviews were conducted face to face, whereas others had to be conducted using distant methods such as via telephone and the Zoom platform. Using distant data collection methods may have impacted the results because of a lack

of visual clues to support transparent and close communication between the researcher and the respondents.

7.6 Future research

This study was conducted to identity the impact of the pandemic and response of small holder vegetable farm households in Sri Lanka to respond to the impacts of the pandemic. Sri Lanka has specific socio-political and cultural characteristics that have influenced the results of this research. Undertaken a similar study in another country with its own distinct context will expand knowledge around farm household responses to shocks but also how these are shaped by the characteristics of the context.

This research highlights the value of accessing different types of markets that draw on a diversified consumer base and different crops that can be sold in varying markets including local market. Future research could explore how smallholders' access to different types of markets and crops contributes to their ability to buffer the impacts of multiple shocks over an extended period.

Vegetables are perishable, non-staple food crops in Sri Lanka. This study provides an opportunity to study the smallholders who relied on a different crop type, such as non-perishable, staple food paddy, where the government intervened differently than vegetables.

This study highlights the need for more research on the multiplicity of shocks farm households experience and the strategies they use to buffer these combinations of shocks and accumulate resources that enable them to develop non-erosive coping strategies. For example, studies on climate change impacts on farm households should acknowledge the multiplicity of shocks experienced by farm households to better understand the impacts and suggest effective interventions for impacted farm households.

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APPENDICES

Appendix A: Information sheet

Impacts of shocks and coping strategies of vegetable farm households in Sri Lanka during COVID-19 pandemic

Researcher(s) Introduction

My name is Sanduni Rathnayake. I am pursuing a PhD in the School of Agriculture and Environment, Massey University, New Zealand, and this project is a requirement of the PhD degree programme.

Project Description and Invitation

The COVID-19 pandemic has brought some unforeseen socio-economic impacts to the whole world. The COVID-19 mitigation strategies introduced by governments have created issues for farmers in relation to agricultural production and marketing, resulting in low financial returns from farming. Vegetable farmers in Sri Lanka are no exception. Vegetables are an essential component of the Sri Lankan people's daily diet, and the sector provides livelihoods for many people across the country. Vegetable farmers and their households need to be resilient to sustain their livelihoods in the future. Many factors have affected the resilience of farm households during COVID-19, but these have not been investigated in the context of Sri Lanka. Therefore, this study seeks to understand the impacts of shocks on vegetable farm households in the Nuwaraeliya and Kandy districts of Sri Lanka during the COVID-19 pandemic and the factors that have influenced this. Also, the research will explore the changes in livelihood activities among vegetable farmers during COVID-19 and how farmer households' financial and social resources have helped them cope during COVID-19.

The research entails the completion of interviews with key informants and vegetable farmers in two districts.

Research Participants Identification and Recruitment and Invitation

Two types of participants will be involved in the study: 1) key informants who are knowledgeable about vegetable farmers' circumstances and 2) farmers who cultivated vegetables before COVID-19 and continue to or have discontinued growing vegetables because of the pandemic. Around ten key informants will be interviewed in the first phase of the study. Key informants will include farmer organisation leaders, field-level extension officers, assistant directors of agriculture, field staff and marketing officers in private sector service provision organisations, vegetable buyers, farmers, and community leaders in the area.

In the next phase, between 20 and 30 vegetable farmer participants will be interviewed from both districts. These participants will be farmers who received or are receiving a significant portion of their household income from vegetables. A diversity of farmers across different farm systems and circumstances will be interviewed. Vegetable farmer names and contact details will be obtained from the agricultural instructors (field-level extension officers) and assistant directors of agriculture in the Nuwaraeliya and Kandy districts and from other farmers.

Therefore, I would like to invite you to take part in this timely study.

Project Procedures

This study will be conducted over a period of one year and five months. Your participation is voluntary. You can decide not to participate or to withdraw from the study at any time.

If you are a key informant:

- A questionnaire will be emailed to you with the consent form and information sheet;
- If you would like to participate in the study, you will be interviewed over the telephone or Zoom
- Interviews will last about 30 minutes;
- If you agree, the interviews will be audio-recorded/video-recorded (in the case of Zoom)
- If you choose to not be recorded; interview notes will be taken by the researcher;
- Neither the recording nor the interview notes will be accessed by anyone other than the researcher.
- Your identity will not be revealed to any external party.

If you are a farmer:

- The questionnaire, the consent form and the information sheet will be shared with you through email or social media such as Facebook, WhatsApp or Viber and discussed with you before the interview
- If you would like to participate in the study, you will be interviewed over the telephone.
- I will ask you to participate in two interviews that will last about 30 minutes per interview.
- The two interview slots will be carried out over a one-month time frame at a time suitable to you
- You will need to answer questions that collect information about your household, age, education, and vegetable cultivation and marketing practices changes to your vegetable farming operation due to COVID-19 and changes in your household due to COVID-19. You will also be asked how your financial situation and social networks have helped you cope with COVID-19.
- If you agree, the telephone interviews will be audio recorded,
- If you choose not to be recorded, interview notes will be taken down by the researcher

- Neither the recording nor the interview notes will be accessed by anyone other than the researcher
- Your identity will not be revealed to any external party.

Data Management

The data obtained for the study will be solely used for academic purposes. Collected data will be under the custody of the researcher, stored on her computer, and destroyed when the study is completed. A summary of this study can be accessed from the PhD thesis produced at the end of the degree programme. Confidentiality of all the data is assured, and no information by which you can be identified will be released or published without your permission.

Participant's Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any time;
- ask any questions about the study at any time during your participation;
- provide information on the understanding that your name will not be used unless you permit the researcher;
- access a summary of the project findings when it is concluded;
- ask for the voice recorder to be turned off at any time during the interview.

Project Contacts

If you have questions about any aspect of this study, please ask any of the individuals listed below.

Primary Researcher: **Sanduni Rathnayake**

- Contact number:0763515016
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LOW-RISK NOTIFICATIONS

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Prof Craig Johnson, Director, Research Ethics, telephone +646 356 9099 x 85271, email humanethics@massey.ac.nz.

Appendix B: Participant consent form

Impacts of shocks and coping strategies of vegetable farm households in Sri Lanka during COVID-19 pandemic

RESEARCH PARTICIPANT CONSENT FORM

I have read or have had read to me in my first language and understood the Information Sheet attached. I have had the study details explained to me, and any questions I had about the study have been answered satisfactorily. I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study. I understand participation is voluntary and that I may withdraw at any time. I also understand that I do not have to answer questions during the interview/survey if I do not wish to.

1. I agree/do not agree to be interviewed/surveyed over the telephone.
2. I agree/do not agree to the interview being sound recorded.
3. I wish/do not wish to have data placed in an official archive.
4. I agree to participate in the interviews/survey under the conditions set out in the Information Sheet attached.

Declaration by Participant:

I _____ [print full name]_____ hereby consent to take part in this study.

Signature: _____ **Date:** _____

Appendix C: Data Collection in Phase II from Key Informants

Impacts of shocks and coping strategies of vegetable farm households in Sri Lanka during COVID-19 pandemic

Interview guide for Key informants

Designation:

Section 1: CONTEXTUAL INFORMATION

A) Pre-COVID context

1. What was your role in vegetable production in the area?
2. What was the role of vegetable farming in the livelihoods of farmers in *Nuwaraeliya* district before the pandemic? How did it vary across farmers?
3. What were the major types of vegetables farmers grew in this area pre-COVID-19? On what basis would you categorise vegetable farmers in *Nuwaraeliya*? (eg. Is it based on the types of vegetables grown or the land area for vegetables? Or something else)
4. How can you classify farmers based on their financial resources?
5. How can you classify farmers based on their connectedness to society?
6. To whom did they sell vegetables pre-COVID-19, and how? Which types of vegetable farmers send their products to which markets, and why?

B) In-COVID context

7. What is your role in vegetable production in the area now? Has it changed, and if so, why?
8. What is the role of vegetable farming in the livelihoods of farmers in *Nuwaraeliya* district now? How does this vary across farmers?
9. How do you categorise vegetable farmers in your area within the current context? On what basis do you categorise vegetable farmers in *Nuwaraeliya*? (eg. Is it based on the types of vegetables grown or the land area for vegetables? Or something else) Has your categorisation changed with the onset of COVID-19?
10. How can you classify farmers based on their financial resources?
11. How can you classify farmers based on their connectedness to society?
12. To whom are they selling vegetables now, and how? Which types of vegetable farmers send their products to which markets and why? How has this changed since the onset of COVID-19?

Section 2: COVID-19 IMPACT ON VEGETABLE FARMERS AND THEIR HOUSEHOLDS AND FARMERS' RESPONSE

13. From your experience, compared to the pre-COVID-19 situation, what impacts has COVID-19 had on vegetable farmers in terms of their 'vegetable production and marketing'? And what has been the reason for this impact?
14. What changes have occurred in the livelihoods of vegetable farmers, and why have these changes occurred?
15. What changes have you observed regarding the impact of COVID-19 on the households of vegetable farmers in the area?
16. Are these impacts different across vegetable farmer groups you identified above? If so, how and why?
17. Has COVID-19 significantly impacted the income of farmers who were 'completely dependent' on vegetables for their income before COVID-19?
18. Has COVID-19 significantly impacted the income of farmers who were' partially dependent' on vegetables for their income before COVID-19?

A) Changes in the scale of production

Stage 1:

19. Do you know of farmers who have completely given up vegetable farming during COVID-19? Do you know why they did this?
20. How have the livelihood activities of these vegetable farmers changed and why?
21. What are the impacts on the income of those farmers?
22. To change livelihood activities, who did they get support from?

Stage 2:

23. Do you know farmers who diversified their existing vegetable area in terms of the types of vegetable crops they grew during COVID-19? Do you know why they did this?
24. How have the livelihood activities of these vegetable farmers changed, and why?
25. What are the impacts on the income of those farmers?
26. From whom did they receive support for such changes in livelihood activities?

Stage 3:

27. Do you know farmers who increased or decreased the area of vegetables they grew during COVID-19? Do you know why they did this?

28. How have the livelihood activities of these vegetable farmers changed, and why?
29. What are the impacts on the income of those farmers?
30. From whom did they receive support for such changes in livelihood activities?

Other combinations:

31. If any, mention other combinations of land area and types of vegetables grown during COVID-19
32. Do you know why did they do this?
33. How have the livelihood activities of these vegetable farmers changed, and why?
34. What are the impacts on the income of those farmers?
35. From whom did they receive support for such changes in livelihood activities?

B) Financial capital and coping strategies related information

36. Financially, what has been the impact of COVID-19 on vegetable farmers? How have they coped financially as individuals and as a household?
37. How do such changes differ among the different types of vegetable farmer groups you mentioned?
38. What are the characteristics of vegetable farmers and their households who have successfully adapted to the impacts of COVID-19? What strategies have they used?
39. What are the characteristics of vegetable farmers and their households that have struggled to cope with the impacts of COVID-19? What strategies have they used?

C) Social capital and coping strategies related information

40. What are the types and nature of vegetable farmers' networks? Have these changed since before COVID-19? How well are their networks functioning now? Have you noticed any major changes that have occurred? Does this vary across the vegetable farmer groups you identified above?
41. Who are the important actors in vegetable farmers' networks that have helped them to respond to the impacts of COVID-19?
42. How about the changes in your relationship with vegetable farmers in your area and farmer involvement in your activities?

D) <u>Service supply-related information</u>

43. How have the services offered by service providers changed due to COVID-19 and why?
44. Did they differ among the different types of vegetable farmers you mentioned above? If so, how?

Appendix D: Data collection in Phase III from vegetable farmers

Farmer Interview Guide

1: Information on changes in vegetable production and marketing

1. Information on vegetable production - Pre-COVID

(types, total land area cultivated, season, input supply-seeds, fertilisers, pesticides, weedicides, loans, labour, advice, information)

2. Temporal changes occurred in vegetable production during the last two years and reasons for such changes

(types, total land area cultivated, season, input supply-seeds, fertilisers, pesticides, weedicides, loans, labour, advice, information)

3. Who/what factors supported/hindered the above changes, and in which way?

(cash reserves, relationships with others)

4. Information on vegetable marketing - Pre-COVID

(volume, place of marketing, mode, types of buyers, unit price (examples), income, cost)

5. Changes occurred in marketing and reasons

6. Who/what factors helped/constrained the above changes, and in which way?

2. Any other changes occurred in the household and the reasons

7. General changes

(changes in income sources, changes in income from vegetables, unemployment, starting a new family business)

8. What did you do to cope with the negative changes that occurred at different times during the last two years?

(Draw on reserves, mortgages, loans, off-farm work)

9. Supportive factors for the above strategies in the household during the last two years

(How and why such factors were important to you)

3: Socio-demographic information

10. Family information

(size, age, relationship, what they are doing now, their education/experience/training information, who is the HH head)

11. Personal information

(age, education level, information on income sources)

12. Information on vegetable farming

(Experience, land size with vegetables at present, total land size, why veg. farming)

Appendix E: List of government documents referred

- Central Bank reports, Sri Lanka- 2019 - 2023
- Household Income and Expenditure Survey Reports, Department of Census and Statistics Sri Lanka
- Health bulletins of Ministry of Health Sri Lanka 2020-2023
- Provincial Department of Agriculture Kandy, Extension plan 2020-2021 Maha season