BUILDING COMMUNITY RESILIENCE TO ECONOMIC IMPACTS OF CLIMATE CHANGE ON LIVELIHOODS: THE METHODOLOGICAL PERSPECTIVE

Malsha Buddha Koralage[1], Udayangani Kulatunga[2] and Bingunath Ingirige[3]

ABSTRACT

Climate change increasingly impacts the livelihoods of communities worldwide, damaging their economies. This raises the necessity of investigating approaches to build community resilience to the economic impacts of climate change. Thus, this study aims to propose a suitable methodology for investigating the economic impacts of climate change on communities using Causal Loop Diagrams (CLDs), an approach under system thinking. A systematic literature review of economic models of climate change was adopted as the best-suited secondary data collection method to identify economic parameters to be investigated. Then, following the philosophical position of interpretivism, with an abductive approach for theory development, is justified as suitable. Considering the credibility of the study, which had more than one data collection method, a multimethod qualitative study was conducted following a survey and case study research strategies. Four staged data collection was conducted following preliminary interviews, focus group discussions, key informant interviews, and expert interviews. Three data analysis techniques of content analysis, cross-case analysis and CLDs, were used to analyse the primary data. Then, the steps taken in this study to achieve reliability, validity, and generalisability are mentioned. These findings will be helpful for researchers in structuring research methodologies to apply system thinking in social science research, ensuring reliability, validity, and ethics.

Keywords: Causal Loop Diagrams; Climate change; Community Resilience; Economic Impacts; Livelihood; Methodology.

1. INTRODUCTION

Conventional wisdom holds that climate change, which is "a dynamic, multidimensional system of changes in environmental conditions that will likely influence human behaviour" (Evans, 2019), results in drastic impacts on community livelihoods, being a fundamental cause for poverty (Feulner, 2017). It results in economic losses, which worsen the living conditions of the population and thereby intensify social issues (Falco et al., 2018). The ability of the global community to respond to climate change has

---

[1] Research Scholar, Department of Building Economics, University of Moratuwa, Sri Lanka, nadeetharubkm.22@uom.lk

[2] Professor, Department of Building Economics, University of Moratuwa, Sri Lanka, ukulatunga@uom.lk

[3] Professor, School of Science, Engineering and Environment, University of Salford, UK, m.j.b.ingirige@salford.ac.uk

become more challenging, and consequently, this has created unexpected economic and/or social changes (Lotstein, 2013). For instance, Falco et al. (2018) predict that climate change will create substantial negative impacts on the global economy, especially in developing countries, and damages will be more apparent in sectors like agriculture. Hence, the economic challenges of climate change are inevitable, and there is an immediate requirement to build community resilience to these economic challenges.

Economic modelling of climate change has been identified as a prompt methodology to determine the impacts of climate change on community livelihoods, as it helps to derive the costs and benefits of climate change and guide the decision-making process in the economy (Rising et al., 2022). Further, Dekens and Hammill (2021) state that economic models of climate change are an assessment mechanism for investigating livelihood impacts as they help to determine costs, benefits, and potential trade-offs of climate change and contribute to ensuring climate change adaption in the economy. However, despite the plenty of studies which use economic models to identify parameters of climate change, which impacts the livelihoods of communities, there is a dearth of studies which apply parameters conveyed in economic models to identify their holistic impacts considering all the parameters and develop strategies to build community resilience to climate change. Here, only the direct impacts of climate change on livelihoods of the communities are considered, without extending to the associated economic impacts like damages to assets etc. Hence, the overarching aim of the study was to contribute to enhancing community resilience to the economic impacts of climate change in Sri Lanka by applying economic models.

Research methodology plays a crucial role in accomplishing research objectives as it contributes to establishing reliable and appropriate research outcomes to achieve the research aim. While there can be multiple research methodologies to accomplish a research aim, good methodology with proper research design is vital to convey reliable, precise, and valid research findings. Thus, this paper focuses on highlighting the methodological perspectives in designing a research methodology to contribute to building community resilience to climate change's economic impacts on Sri Lanka's livelihoods, unveiling evidence on unique experiences, foreseeable research challenges, ethical considerations, and best practices. The investigation and implementation of this methodology will support current and upcoming initiatives to advance the community's resilience to the economic impacts of climate change.

2. RESEARCH PROCESS DESIGN

The research process refers to the plan of structuring a research problem to arrive at conclusions (either implicit or explicit), which can be explained as the logical framework (Yin, 2013). It is iterative and dynamic process, which involves collaboration, reflection, and adaptation. Thus, the overall research was divided into five main objectives as listed below to structure next stages.

I. Review economic models of climate change and the different climatic conditions and economic parameters used in economic models of climate change.

II. Identify the economic impacts of climate change conveyed in economic models.

III. Investigate the different climatic conditions and economic parameters applicable to the Sri Lankan context.

IV. Investigate the economic impacts of different climate conditions on the livelihoods of communities in Sri Lanka.

V. Provide recommendations to increase community resilience against the economic impacts of climate change on livelihoods.

Each objective focused on some related but distinct aspects of climate resilience of community livelihoods and thus need different levels of investigations, interactions, and data collection instruments. Hence, development of a proper research methodology from the initial point of research is critical. Thus, for the literature review, 32 research studies that used economic models of climate change in the context of agriculture were selected using a Systematic Literature Review (SLR) with PRISMA search protocol, which is considered as a credible research methodology for a literature review. This is used to determine the parameters to be investigated with primary data collection along with the data collection and analysis techniques. Then, following the Saunders research onion (Saunders et al., 2019), as shown in Figure 1, an appropriate research methodology for this context has been developed, which is discussed in the following sections.
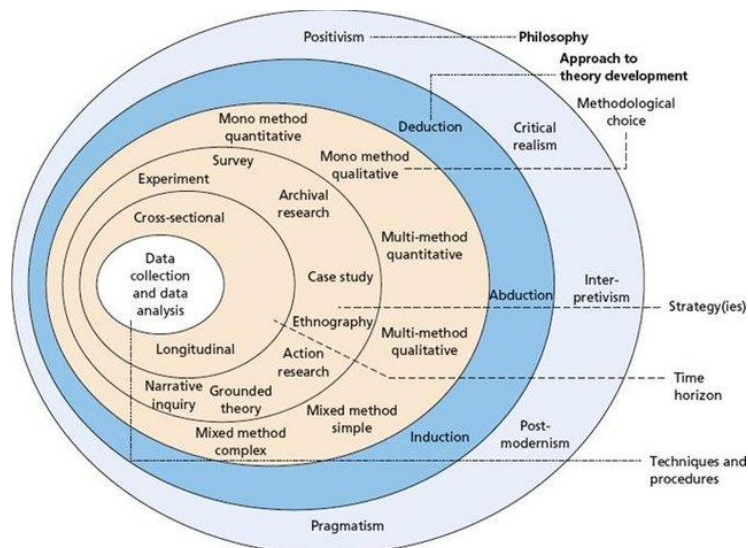

Figure 1: Saunders research onion (Source: Saunders et al., 2019)

2.1 RESEARCH PHILOSOPHY

The researcher's philosophical perspective determines how data is gathered, analysed, and interpreted in research to arrive at conclusions (Walliman, 2021). Accordingly, Ontology, epistemology, methodology, and methodologies are thus included in the philosophical components of the research philosophy (Rehman & Alharthi, 2016). The research onion by Saunders et al. (2019) identifies five research philosophies, and the conclusion was that this study suits the philosophy of interpretivism.

Interpretivism assumes that there is no universal truth (Dudovskiy, 2022), and reality can be perceived through subjective measures depending on the context. Further, interpretivists argue that humans cannot be separated from the knowledge that is created (Saunders et al., 2019) and that they provide researchers with the ability to be a part of the research where the findings are value laden. This study focused on identifying the economic impacts of climate change on communities, where the communities cannot be separated from what is being found, and different views and perspectives of human beings

provide rich insights into the research problem. Further, providing recommendations to issues identified within the context of the industries requires the opinions of the most knowledgeable people on the problem and are not predefined theories but are those emerging from the context. Therefore, this study promotes subjective values and data created by the affected society. Thus, the interpretivism research philosophy was identified as the most suitable philosophy in this context.

2.2 APPROACH TO THEORY DEVELOPMENT

As indicated in the second layer of the research onion, three approaches to theory development can be identified: induction, deduction, and abduction. Furthermore, according to Saunders et al. (2019), the deductive approach involves testing the existing theories, while the inductive approach produces or generates new theories. The abductive research approach facilitates a combination of both inductive and deductive approaches. The aim of the original study is to contribute to enhancing community resilience to the economic impacts of climate change in Sri Lanka through the application of economic models. This aligns with the generation of knowledge and testing or verifying the existing economic parameters from the global context. It is context-specific, and economic impacts are required to be generated from the context simultaneously with the use of parameters identified from the literature review. Thus, the abductive research approach can be justified as the most suitable research approach for this study.

2.3 METHODOLOGICAL CHOICE

The next layer of the Saunders et al. (2019) research onion refers to the methodological choice, which can be identified in three main choices: qualitative, quantitative, and mixed method. According to Walliman (2021), the questions in terms of "how much", "how many", "what", "who", and "where" were used for quantitative research methods. In contrast, qualitative research methods study the textual data gathered through the views, experiences, attitudes, and beliefs of humans and, therefore, generally follow the question types of "how" and "why" (Fellows & Liu, 2015). As suggested by its name, the mixed method combines qualitative and quantitative methods (Doyle et al., 2009). This study deals with the research question of "How the resilience of different livelihoods of communities in Sri Lanka can be built up against climate change", providing textual evidence. There are multiple possibilities to address this research question via qualitative or mixed method research. However, considering the time limitation, and lack of required sample to perform quantitative study, this study was aligned to qualitative research methods following below concerns. This requires input from various community groups, including the people whose livelihoods are affected, authorities currently connected to handle the impacts on livelihoods, and academic or theoretically feasible strategies to be implemented through expert groups. Following the two above requirements, this study incorporates the "multi-method qualitative" methodological choice.

2.4 RESEARCH STRATEGY

The research strategy refers to a general plan which structures the path to conducting research (Yin, 2014). Furthermore, it helps to identify the research problem in detail and develop accurate solutions to it (Mohajan, 2017). As per Saunders et al. (2019), research strategies suitable for a particular study are determined based on the selected research approach. Further to Yin (2014), there is no extant strategy or set of strategies for a

research problem and it can be investigated through multiple appropriate possibilities based on reliable arguments and structure. Following that, this study uses two different research strategies of a survey, which is for Stage 01 (preliminary interviews) and Stage 04 (expert interviews), and case studies for Stage 02 (focus group discussions) and Stage 03 (key informant interviews) of data collection. The following subsections describe the rationale for adhering to particular research strategies. Though the research question, suits "action research" methodology as well, considering the time-consuming nature of action research, the below two strategies were used.

2.4.1 Survey Research Strategy

A survey is a research strategy suitable for both qualitative and quantitative data collection in a study (Cherry, 2023) to collect data from a population or a sample using a systematic procedure (Mathiyazhagan & Nandan, 2010). Furthermore, it is appropriate for answering questions which involve "who", "what", "where", "when", "how many", and "how much" (Fellows & Liu, 2015). As the preliminary interviews of this study focused on identifying "the parameters and climatic conditions derived from the economic models are prevailing in Sri Lanka", carrying out a survey was considered as the most appropriate strategy for Stage 01 - preliminary interviews data collection. Moreover, for identifying a set of strategies to build up community resilience against climate change, a survey strategy was identified as suitable, as it focuses on the question of "how community resilience to climate change is ensured in tea and paddy industries?".

2.4.2 Case Study Research Strategy

Case study refers to "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between the phenomenon and context are not clearly evident and in which multiple sources of evidence are used" (Yin, 2009). According to Yin (2014), case studies can be identified as the most suitable research strategy for research problems comprising of "why" or "how" questions as they provide an in-depth investigation to answer the research question. As this study required in-depth empirical investigations to identify the economic issues experienced by the community consequent to climate change, case studies were selected as the suitable strategy for that. Accordingly, Objective 04 utilised the data collection methods followed by case studies.

Design of Case Studies

There are two case study designs, as Yin (2009) revealed: single case study design or multiple case study design. A single case study design is used in situations where a common case, longitudinal case, critical case, unusual case, or revelatory case were studied (Yin, 2014). Since this study focuses on investigating the economic impacts of climate change on the livelihoods of communities in Sri Lanka evidence from multiple case studies were deemed appropriate.

Selection of Cases

The selection criteria of cases of the case study depend on the parameters of judgement, convenience, and time and cost limitations (Yin, 2014). The selection is based on "replication", which is two types: theoretical replication and literal replication (Saunders et al., 2019). Literal replication forecasts similar results from multiple cases, whereas theoretical replication predicts contrasting results in multiple cases for predicted reasons (Yin, 2017). This study selected literal replication as the appropriate replication logic because of the expectation of seeing similar results in multiple case studies. A study

conducted in Kerala, India, regarding the impacts of climate change on different cropping systems, stated that climate change tends to similarly impact both paddy and tea cultivation and act as a cause to reduce harvest (Rao et al., 2008). Another study in Eastern Africa also conveyed a similar view and stated that climate change causes a reduction of the output in both tea and paddy cultivation (Adhikari et al., 2015). Following that, this study uses literal replication in selecting cases. However, this study aims to investigate multiple impacts of climate change on the two crops, tea and paddy, in addition to reducing output. Henceforth, the findings are predicted to differ depending on the nature of the industry.

Since Sri Lanka displays different climatic patterns across various regions which are differently affected by climatic impacts, this research selected the low-country wet zone as the region for investigation based on the findings of Wickramashinghe et al. (2021), which identified the low-country wet zone as a highly vulnerable area to climate change, especially the southwestern part of it. Since the research aim was to contribute to enhancing community resilience to the economic impacts of climate change in Sri Lanka by applying economic models within the context of agriculture, different livelihoods under agriculture were selected as the case study boundary. Following time constraints, the number of cases was limited to two. The rationale for selecting two different livelihoods from agriculture is mentioned below.

Justification of Selected Livelihoods and Selected Case from Each Livelihood

Being paddy the primary food crop of Sri Lanka, and tea is identified as the primary source of foreign exchange ("Sri Lanka-Country Commercial Guide", 2024), these two crops have been selected for this study. Furthermore, tea and paddy were determined to be the two most vulnerable industries in Sri Lanka by the end of 2022 for several reasons, including weather challenges (Chandrasiri et al., 2023). Accordingly, "tea" and "paddy" were selected as two livelihoods for the case studies.

Selection of appropriate case for research is based on the researcher's judgement, followed by convenience and accessibility to data. Accordingly, cases were judged based on the frequency of damages to cases during the last five years, followed by the inclusion of any extreme events. The selection of cases was based on the criteria including, (1) cases should be based on low country wet zone, (2) industry (tea or paddy as per the case) should be the primary source of income of the participants, (3) should undergo challenges consequent to at least one of the main climatic conditions identified, (4) should have at least 12 farming families who suffer from the difficulty of continuing their livelihood mainly due to climatic barriers, and (5) accessibility to community, officers, and documents (if required).

Defining the Unit of Analysis

The selection of a unit of analysis in a case study is directly related to the research question being investigated (Yin, 2014), which is the economic impacts of climate change on different livelihoods in this research study. Accordingly, holistic cases refer to cases with a single unit of analysis, while embedded cases follow multiple units of analysis (Rowley, 2002). In this case, the data is collected on the economic impacts based on different livelihoods as the boundary. Thus, the unit of analysis has determined the "economic impacts of climate change" in these two cases, which follows a holistic case study design with a single unit of analysis.

2.5 TIME HORIZON

The next layer of the research onion proposed by Saunders et al. (2019) is the time horizon, which is identified under the cross-sectional and longitudinal categories. Cross-sectional refers to studies where data is collected at a particular time, while longitudinal conveys periodical studies in which data collection occurs over a period of time. Thus, this study falls into the category of cross-sectional approach where the study is conducted in the prevailing context. Longitudinal studies also suitable for this context, since climate change is an evolving concern, and however again it is restricted because of time constraints.

2.6 DATA COLLECTION TECHNIQUES

Data collection is the innermost layer of research onion of Saunders et al. (2019). The data used in this study falls under the two main categories of primary and secondary data. Secondary data was collected through the literature review, based on a SLR methodology following a PRISMA protocol. Since, this is a community-based research, primary data collection methods were determined considering several factors. Knowledge of the participants to understand the context, availability of participants who experienced the relevant issue and have metacognition on it, lack of technical capabilities of participants to access digital data collection tools like questionnaires, their lack of literacy and desire to spend time on manually filling research instruments, language barriers, and access to data in upcoming data collection rounds (after the community, access to key informants in the particular case should be there) are considered as main factors to determine data collection methods, instruments and sampling techniques. Thus, the primary data collection for this study is aligned in four stages within the two research strategies. Accordingly, preliminary interviews have been conducted with two academic experts selected based on convenience to refine the identified parameters from economic models to the Sri Lankan context. The next three stages of data collection followed judgemental sampling. A case study strategy was selected for the following two stages of data collection to conduct focus group discussions and key informant interviews, respectively, for each case. Finally, expert interviews were conducted to identify suitable strategies to build up community resilience to the economic impacts of climate change on two livelihoods. All four stages of data collection were conducted physically (face-to-face). The data collection language was English in Stage 01, Stage 03 and Stage 04. Stage 02 of data collection was conducted in Sinhala (the native language in Sri Lanka) as the community is unfamiliar with English. Further, prior to attending Stages 02 and 03 data collection, a background search was done to ensure whether all the participants can understand "Sinhala" language, since there are Tamil speaking communities are in Sri Lanka.

Ethical consideration is a significant aspect to be concerned in proper research and several strategies to maintain ethical nature of the study were incorporated. Formal procedures were followed in taking approvals to data collection like formal letters. Moreover, checklists were prepared for participant selection including both mandatory and optional criteria. Further, respect participants' availability and give them priority in deciding time and location. Also, the research background, aim, and benefits of the outcomes of the study was explained in laymen language and provide them with opportunity to clarify any questions they have before participation. Their individual consent is obtained regarding

participation and recording to ensure voluntary participation and provide them with the opportunity to withdraw at any time of the data collection.

2.7 DATA ANALYSIS TECHNIQUES

Since this study involves qualitative data, three qualitative data analysis techniques were selected for data analysis. Thus, the findings of Stage 01 were analysed through content analysis as it is the most popular analysis method for text data, which encrypts data with clear codes (Hsieh & Shannon, 2005). Acknowledging two methods of content analysis as manual and software based, this study utilised manual content analysis, considering the researcher's requirement to have an in-depth investigation of the data and the capacity of the data to be handled manually. The next three stages of data collection were followed by multiple methods of data analysis, such as manual content analysis, cross-case analysis and causal loop diagrams (CLDs) in system thinking for all three stages. As stated by Rose et al. (2014), the findings of the case studies are helpful and rational if cross-case analysis and tabular presentation are used. Thus, cross case analysis was conducted for the findings of two case studies. Further, since the researcher aimed to analyse the data using system thinking and CLDs (justification for using this approach is explained in subsection 3.7.1), questions were directed to have a detailed investigation on both causes and effects of climate variability and causes and consequences of change in the parameters identified through the SLR.

2.7.1 System Thinking and Causal Loop Diagrams (CLDs)

System thinking refers to the process of providing a holistic view of a problem where the components associated with the problem are presented in a graphical way that emphasises their relationships. This helps determine the behaviour of the components over time (Dhirasasna & Sahin, 2019). Further, it helps to develop a conceptual model of the parameters associated with a particular context by considering the context as a system. It helps to visualise their relationships (Crielaard et al., 2022). CLDs are conceptual models (qualitative) or structures that link the relationships between a set of causes and effects (causalities) of a particular instance or problem (Haraldsson & Bonin, 2021). It follows system thinking and considers the instance/problem and its causes and effects as a system (Groundstroem & Juhola, 2021).

As Dhirasasna and Sahin (2019) explain, CLDs are suitable for complex problems that change over time. Climate change can be considered a complex problem that changes over time (Evans, 2019) and creates concurrent impacts on the livelihoods of the community (Feulner, 2017). Accordingly, a visual representation of the impacts of climate change on livelihoods as a holistic system helps to determine the causes and consequences of the impacts on livelihood and their relationships, which will assist the users and decision-makers in studying the behaviours, predicting actions and controlling the impacts. Thus, CLDs have been identified as an effective way of analysing the identified parameters within the context of the economic impacts of climate change on livelihoods. Moreover, CLDs provide reliable results when incorporating the perspectives of multiple stakeholders (Dhirasasna & Sahin, 2019). As this study includes data collection from a wide range of respondents (focus groups of farmers, officers from administration and academic experts), the construction of reliable CLDs can be ensured.

Overall, according to Jonker and Pennik (2010), the research methodology is one that outlines the most logical, transparent, and explicit route the researcher desires to follow

to address the study problem, including ideas for the origination of research, its direction, and action plan, as well as the most appropriate methods for data collecting and analysis. Accordingly, Figure 2 demonstrates the graphical framework of the research process adhered to in this study.
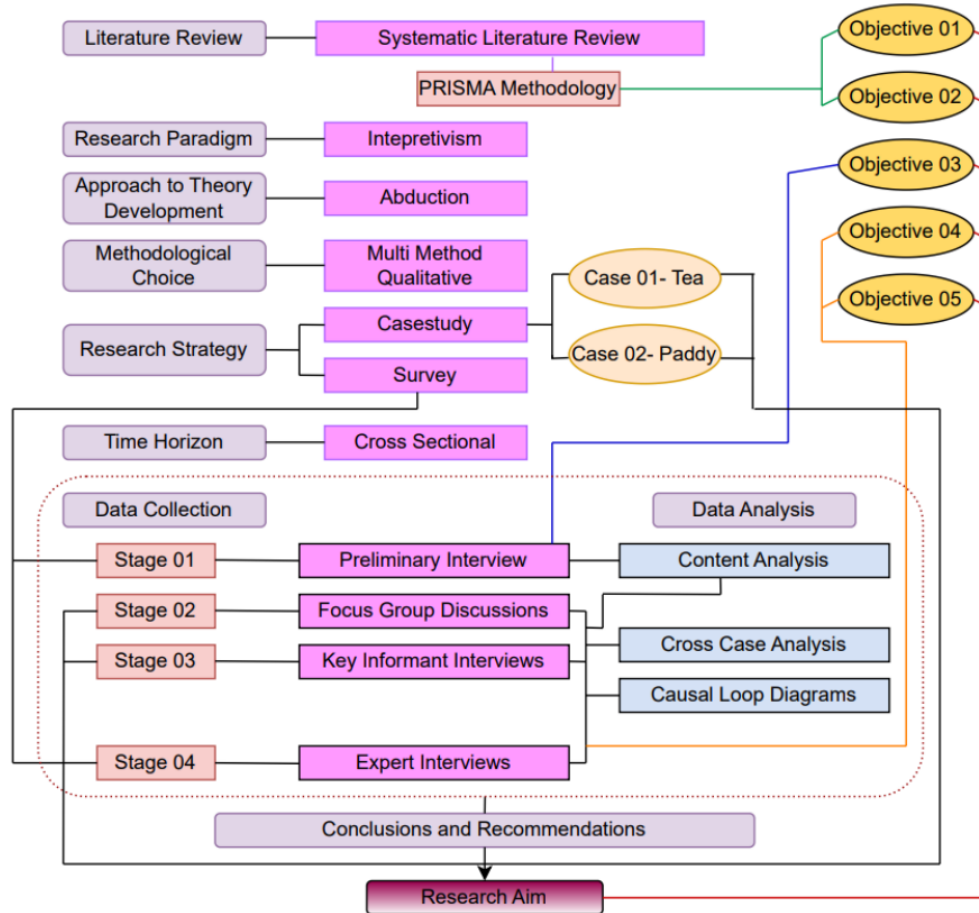

Figure 2: Research process

Through the experience of conducting this study, some best practices for research design in community research are to analyse different options with related strengths and weaknesses, acknowledge time and resource constraints, convey the participants about the need of the outcomes of the study in understandable vocabulary, acknowledge value of their participation with a proper welcome, always respect participants privacy and prioritise their convenience, maintain dynamic relationships with participants to ensure their active participation, arrange the order of the questions to maintain participants enthusiasm without feeling bored, and respect their questions. Further, being prepared and obtaining help of peers in organising the events also ensure successful outcomes.

3. RELIABILITY, VALIDITY, AND GENERALISABILITY OF RESEARCH FINDINGS

The ability of a researcher to reach the same findings and conclusions by using the same methods as the original researcher is what constitutes a study's reliability (Yin, 2017). Henceforth, reliability aims to reduce the biases and inaccuracies of the research. Further to Yin (2017), proper and detailed documentation of information and procedures followed

is essential to derive an appropriate conclusion. Accordingly, Section 02 explains the detailed procedures followed in the four data collection and analysis stages. Moreover, adhering to SLR also increased the reliability of the study. The CLDs developed were validated with pattern matching with the literature, internal validity, construct validity and validation from a CLD expert external to the study. This study follows the data validation approach through the subsequent data collection round. Thus, the findings of Stage 01 were further investigated to validate Stage 02 - focus group discussions; findings of Stage 02 were validated with key informants (Stage 03), and findings of Stage 03 were validated through experts (Stage 04). Accordingly, this study used multiple sources of evidence to validate case studies, known as construct validity (Rowley, 2002).

Generalisability is limited in qualitative research as it focuses on developing content-specific and theme development instead of obtaining generalised findings (Creswell & Creswell, 2018). Nevertheless, there is an ability to generalise the findings of the case studies outside the immediate study. This can be referred to as transferability rather than generalisability, as this follows a discussion of other situations where the obtained findings might be relevant (Shemilt et al., 2011). This study uses two cases in the low country wet zone, the tea and paddy industry, which can be appropriate and transferable into other wet zone areas of Sri Lanka. Moreover, the findings can be relevant and transferable to tea growers who are suffering from landslides, as well as paddy growers who are subjected to floods. Since climate change is a global issue affecting the entire world community, the findings generated may be transferable to other industries of tropical countries subjected to similar climatic conditions and threats.

To sum up, this overall research design helps in fulfilling the research aim while maintaining research ethics, reliability and validity of findings, and good practices.

4. CONCLUSIONS

This paper discusses the authors' effort to develop a suitable methodology to investigate the economic impacts of climate change on the livelihoods of the communities to build resilience, focusing on agricultural livelihoods in Sri Lanka, maintaining research ethics and credibility. Thus, the adopted method played a significant role in disclosing valuable information and recommendations. Specifically, the methodology based for literature to identify parameters to determine economic impacts provides a holistic and reliable set of parameters for further investigation. Moreover, using case studies to investigate the problem in a real-life context ensures an accurate representation of the problem from those who have suffered. Besides, key informant interviews also disclosed real-life views from a decision-making perspective, which was finally helpful in developing reliable strategies. Overall, designing the research method from a descriptive perspective keeping records from the initial stage about expected outcomes, exploring multiple options, understanding challenges and limitations, and reviewing the reliability of research methods, help to mitigate the challenges of this study to ensure reliable outcome. The findings of this study will be beneficial for researchers who focus on applying CLDs to climate change and disaster contexts to structure a proper methodology for their data collection. Moreover, future studies can be conducted by applying the same methods to different climate contexts, climate-induced disaster contexts, and livelihood contexts in other geographical areas.

5.   ACKNOWLEDGEMENTS

6.   REFERENCES

Adhikari, U., Nejadhashemi, A. P., & Woznicki, S. A. (2015). Climate change and eastern Africa: A review of impact on major crops. *Food and Energy Security, 4*(2), 110–132. https://doi.org/10.1002/fes3.61

Chandrasiri, C. K., Tsusaka, T. W., Ho, T. D. N., Zulfiqar, F., & Datta, A. (2023). Impacts of climate change on paddy yields in different climatic zones of Sri Lanka: A panel data approach. *Asia-Pacific Journal of Regional Science, 7,* 455-489. https://doi.org/10.1007/s41685-022-00264-5

Cherry, K. (2023, November 15). *When to use surveys in psychological research.* Verywellmind. https://www.verywellmind.com/what-is-a-survey-2795787

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed method approaches* (5th ed.). Sage Publications. https://spada.uns.ac.id/pluginfile.php/510378/mod_resource/content/1/creswell.pdf

Crielaard, L., Uleman, J. F., Châtel, B. D. L., Epskamp, S., Sloot, P. M. A., & Quax, R. (2022). Refining the causal loop diagram: A tutorial for maximizing the contribution of domain expertise in computational system dynamics modeling. *Psychological Methods, 29*(1), 169-201. https://doi.org/10.1037/met0000484

Dekens, J., & Hammill, A. (2021). *Using climate economic modelling for sustainable economic development.* https://policycommons.net/artifacts/1806233/using-climate-economic-modelling-for-sustainable-economic-development/2539474/

Dhirasasna, N., & Sahin, O. (2019). A multi-methodology approach to creating a causal loop diagram. *Systems, 7*(3), 42. https://doi.org/10.3390/systems7030042

Doyle, L., Brady, A. M., & Byrne, G. (2009). An overview of mixed methods research. *Journal of Research in Nursing, 14*(2), 175–185. https://doi.org/10.1177/1744987108093962

Dudovskiy, J. (2022). *An ultimate guide to writing a dissertation in business studies: A step-by-step assistance* (6th ed.). http://research-methodology.net/about-us/ebook/

Evans, G. W. (2019). Projected behavioral impacts of global climate change. *Annual Review of Psychology, 70*, 449–474. https://doi.org/10.1146/annurev-psych-010418-103023

Falco, C., Donzelli, F., & Olper, A. (2018). Climate change, agriculture and migration: A survey. *Sustainability, 10*(5), 1405. https://doi.org/10.3390/su10051405

Fellows, R., & Liu, A. (2015). *Research methods for construction* (4th ed.). Wiley-Blackwell. https://www.wiley.com/en-us/Research+Methods+for+Construction%2C+4th+Edition-p-9781118915738

Feulner, G. (2017). Global challenges: Climate change. *Global Challenges, 1,* 5-6. https://doi.org/10.1002/gch2.1003

Groundstroem, F., & Juhola, S. (2021). Using systems thinking and causal loop diagrams to identify cascading climate change impacts on bioenergy supply systems. *Mitigation and Adaptation Strategies for Global Change. 26*(29). https://doi.org/10.1007/s11027-021-09967-0

Haraldsson, H., & Bonin, D. (2021). *Using systems approach to integrate causal loop diagrams modelling in the foresight project scenarios for a sustainable Europe 2050.* Swedish Environmental Protection Agency. https://www.diva-portal.org/smash/get/diva2:1579896/FULLTEXT01.pdf

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Sri Lanka-Country commercial guide. (2024, May 08). International Trade Administration. https://www.trade.gov/country-commercial-guides/sri-lanka-agricultural-sector

Jonker, J., & Pennink, B. (2010). *The essence of research methodology: A concise guide for master and PhD students in management science.* Springer Science & Business Media.

Lotstein, E. L. (2013). Global climate change impacts in the United States: A State of knowledge report from the U.S. global climate change research program. *Journal of Geography, 112*(4). https://doi.org/10.1080/00221341.2013.770905

Mathiyazhagan, T., & Nandan, D. (2010). Survey research method. *Media Mimansa, 4*(1), 34–45. https://krishanpandey.com/rpapersd/Surver-Content.pdf

Mohajan, H. K. (2017). Two criteria for good measurements in research: Validity and reliability. *Annals of Spiru Haret University. Economic Series, 17*(4), 59– 82. https://doi.org/10.26458/1746

Rao, G. S. L. H. P., Mohan, H. S. R., Gopakumar, C. S., & Krishnakumar, K. N. (2008). Climate change and cropping systems over Kerala in the humid tropics. *Journal of Agrometeorology, 10*(2), 286– 291. https://www.cabidigitallibrary.org/doi/full/10.5555/20093179081

Rehman, A. A., & Alharthi, K. (2016). An introduction to research paradigms in distance education. *International Journal of Educational Investigations, 3*(8), 51–59.

Rising, J., Tedesco, M., Piontek, F., & Stainforth, D. A. (2022). The missing risks of climate change. *Nature, 610*, 643–651. https://doi.org/10.1038/s41586-022-05243-6

Rose, S., Spinks, N., & Canhoto, A. I. (2014). *Management research: Applying the principles* (1st ed.). Routledge. https://doi.org/10.4324/9781315819198

Rowley, J. (2002). Using case studies in research. *Management Research News, 25*(1), 16–27. https://doi.org/10.1108/01409170210782990

Shemilt, I., Mugford, M., Vale, L., Marsh, K., & Donaldson, C. (Eds.). (2011). *Evidence-based decisions and economics: Health care, social welfare, education and criminal justice*. John Wiley & Sons. https://doi.org/10.1002/9781444320398

Saunders, M., Lewis, P., & Thornhill, A. (2019). Research methods for business students (8th ed.). Pearson Education Limited. http://localhost:8080/xmlui/handle/123456789/490

Walliman, N. (2021). *Research methods: The basics.* Routledge. https://doi.org/10.4324/9781003141693

Wickramasinghe, M. R. C. P., De Silva, R. P., & Dayawansa, N. D. K. (2021). Climate change vulnerability in agriculture sector: An assessment and mapping at divisional secretariat level in Sri Lanka. *Earth Systems and Environment, 5*(3), 725–738. https://doi.org/10.1007/s41748-021-00206-9

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Sage Publications.

Yin, R. K. (2013). Validity and generalization in future case study evaluations. *Evaluation, 19*(3), 321– 332. https://doi.org/10.1177/1356389013497081

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Sage Publications.

Yin, R. K. (2017). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.