

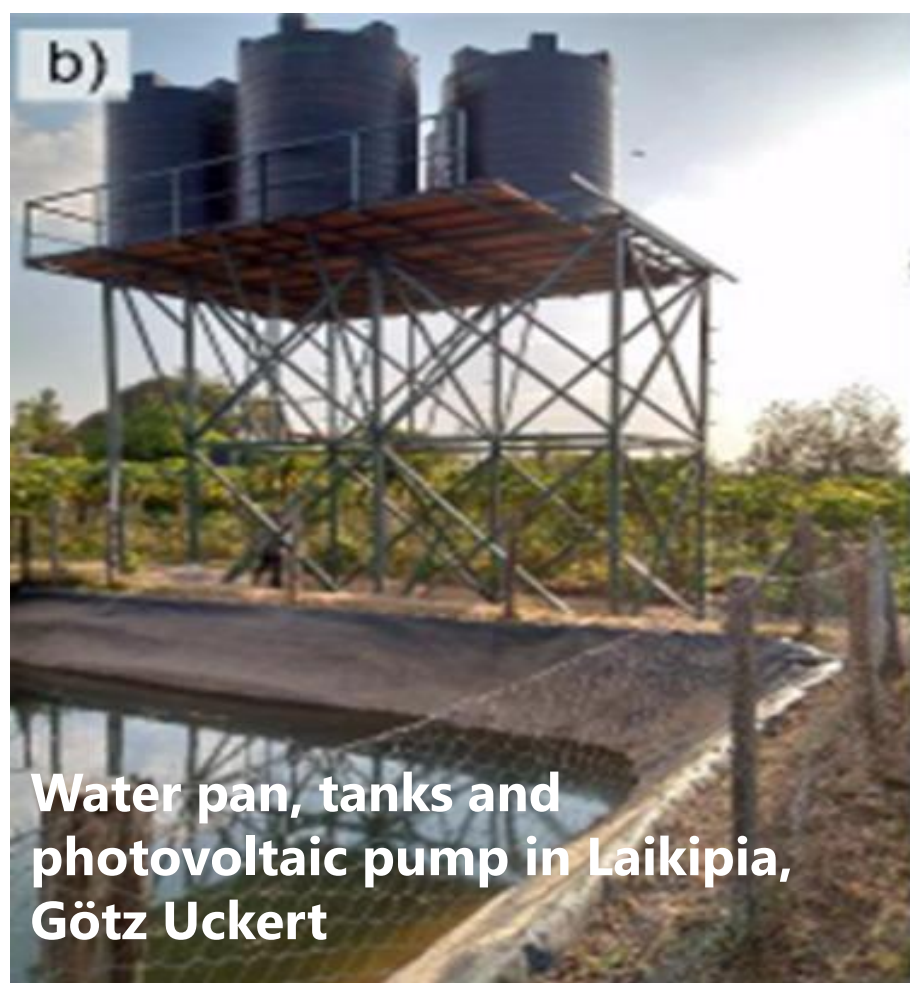
Interplay between technological transformation, rural welfare, collective action and water conflicts in Mount Kenya, a system approach.

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1. Introduction

- Smallholder farmers in Kenya face growing water challenges, as the detrimental effect of climate change are furtherly exacerbated by agricultural expansion and competition over water resources.
- Rainwater harvesting (RWH)**, farm ponds and more efficient irrigation technologies are being promoted as key climate adaptation strategies.
- A few pioneer farmers and local commercial farms are integrating **Rain Water Harvesting, micro-irrigation** and **Solar Powered Irrigation Systems (SPIS)**, operationalising **Water-Energy-Food (WEF) Nexus strategy** at the **farm level**. Yet, small holders' uptake remains limited due to many factors.



2. Research Gap

Little is known about how **socio-economic**, **institutional**, **ecological**, and **technological factors** interact to enable or hinder widespread uptake of these integrated systems in the Mount Kenya region.

3. Objectives

- To develop a **stakeholders' informed QSDM** that systemically examine the dynamics that leads to conflicts over water access in the **Timau catchment**, and
- to identify the **cycle of barriers** that hinder adoption of the WEF strategy, while perpetuating water disparity dynamics within the catchment.

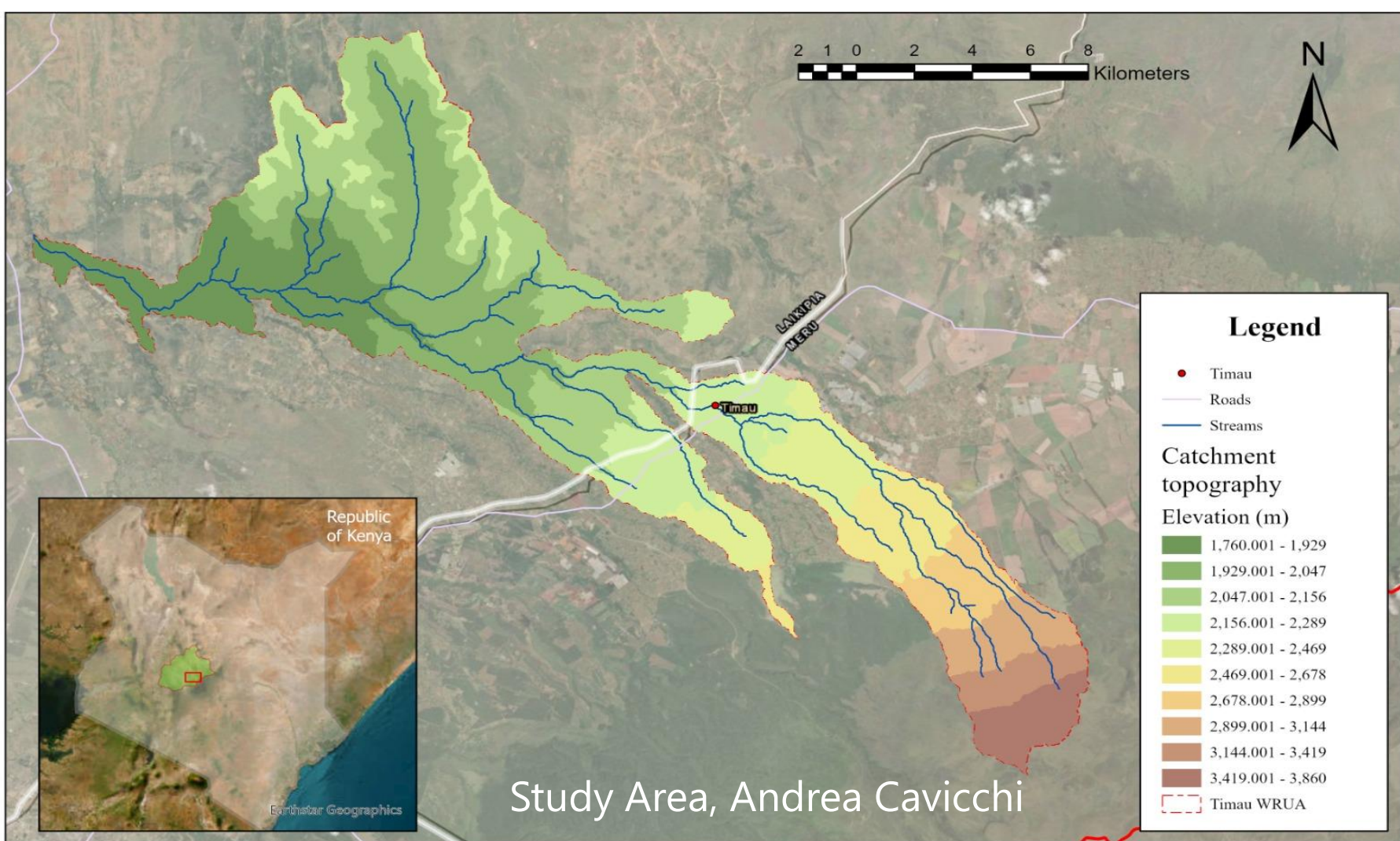
4. Research Questions

- What are the main Social-ecological-technical interactions within the small scale farming sector affecting water resources' and environmental flows' dynamics within the Timau river system?
- What are the main barriers to the adoption of RWH, drip and sprinkler irrigation, and SPIS, and how could their upscaling change the socio-ecological dynamics of the system under study?

5. Methodology

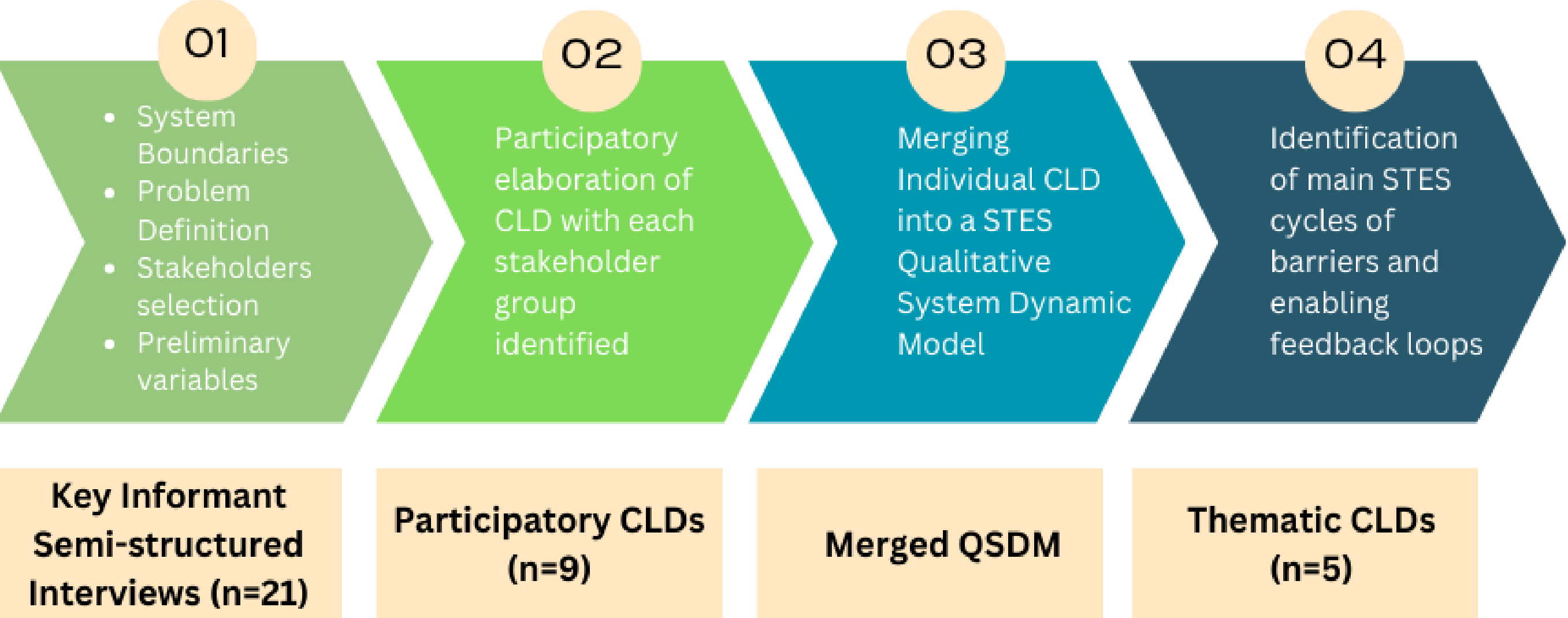
Study Area

The Timau catchment lies within Meru and Laikipia Counties. The basin suffers from increasing **land and resources competition** and **growing scarcity of surface water**.



Site Selection Rationale: High concentration of small scale farms; presence of Highland-lowland and human-wildlife water related conflicts; low adoption rate of climate smart technologies.

Methodological Framework

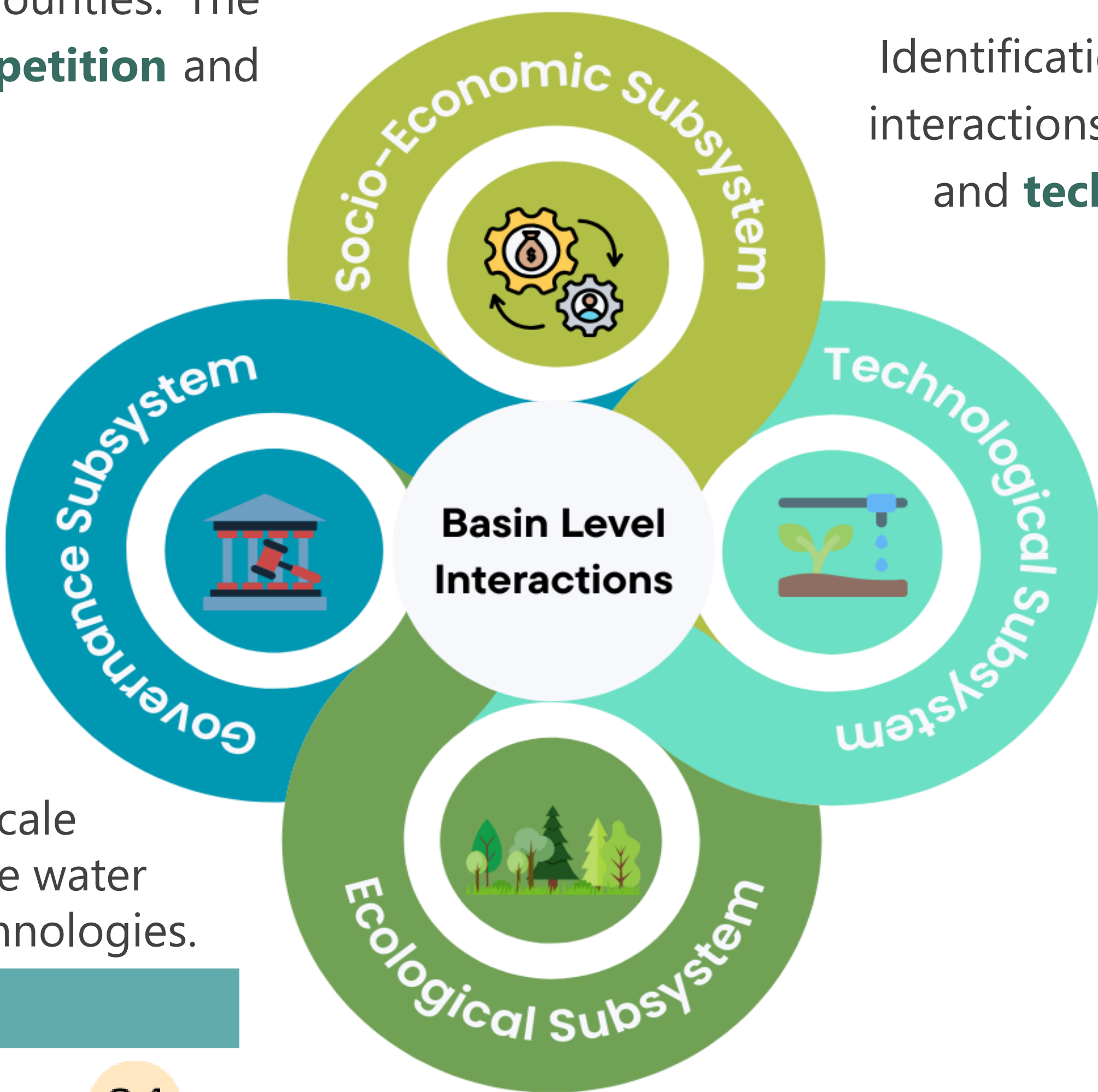


Theoretical Framework for Data Analysis

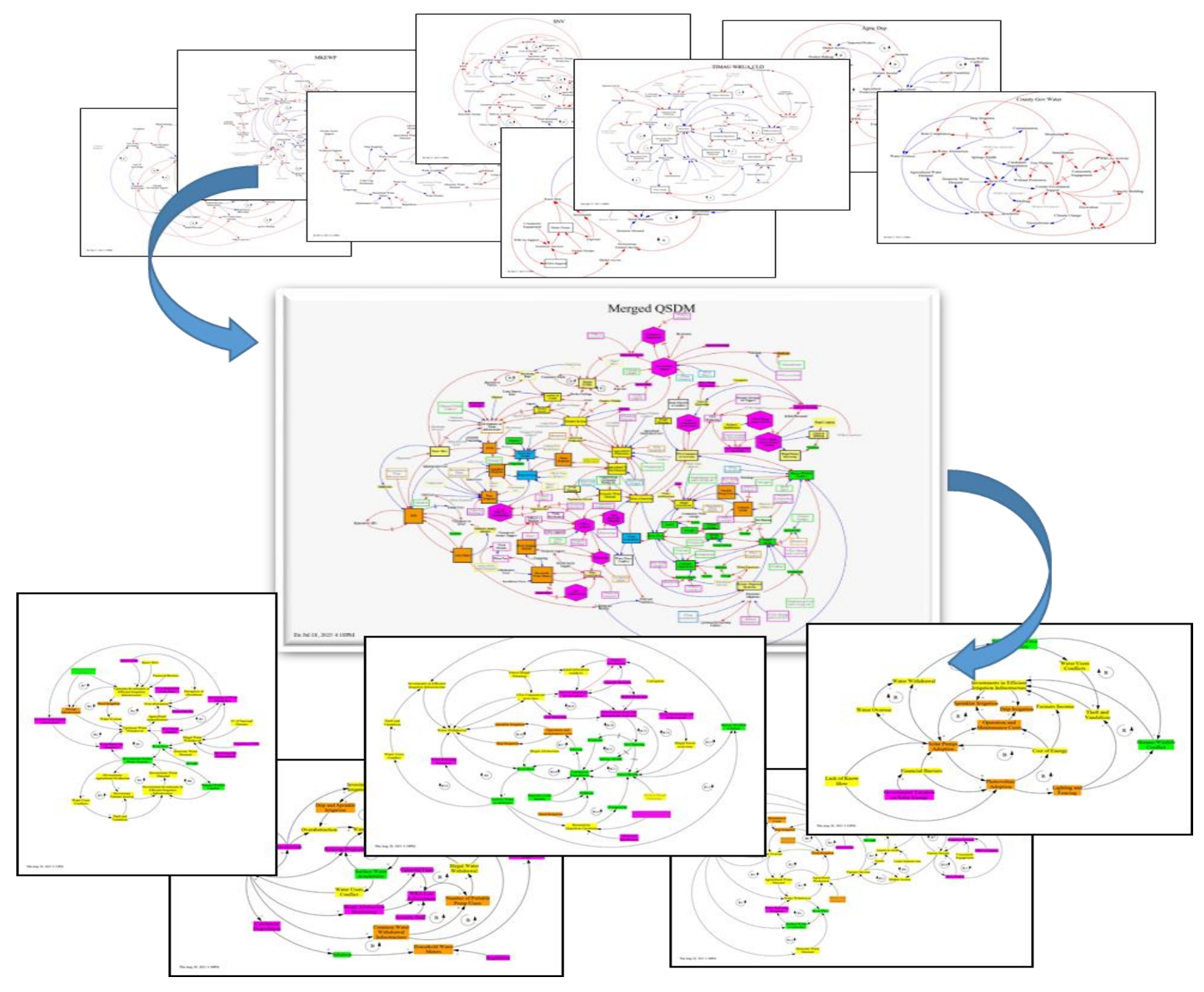
Categorization of variables and Basin-Level interactions into a **STES Model**.

STES variables	Evaluation of technological variables	Conceptualization of Resources	Theories
Ecological Social Economic Governance Technological	4 groups based on its impact on a socio-economic and eco-hydrological system	Surface Water Resources as CPR	Complex Adaptive Systems CPR Theory Adoption Theory

6. Results



Identification of **5 Thematic Causal Loop Diagrams** displaying the interactions between the **socio-economic**, **ecological**, **governance** and **technological sub-systems** of **Timau's STES** hindering and enabling the WEF Nexus strategy at the farm level.



7. Conclusion

Weak **monitoring**, low **sanctions**, and **illegal water withdrawals** drive **over-abstraction**, fuelling agricultural intensification in the highlands, and downstream water scarcity. Reliance on **flood irrigation**, limited **economic incentives**, poor **financial access**, and **high taxation on photovoltaic** discourage adoption of RWH, micro irrigation, and SPIS. Lowland farmers remain trapped in **poverty** and **water conflicts**, while catchment degradation and **siltation** further undermine precision irrigation through high maintenance costs. Strengthening **farmer cooperatives** and **grassroots organizations** is essential to improve **market access**, **financing**, **awareness**, and **know how**, enabling wider adoption of climate-smart technologies.

8. References

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