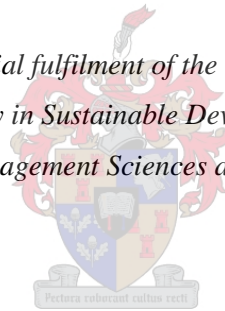


**A community model for water-energy-food security nexus development:
cultivating sustainable livelihoods and an adaptive comanagement approach in
rural Mozambique**

by

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*Thesis presented in partial fulfilment of the requirements for the degree of
Master of Philosophy in Sustainable Development in the Faculty of
Economic and Management Sciences at Stellenbosch University*



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Declaration

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Abstract

Mozambique is one of the poorest and least developed countries in the world. In its 2019 Human Development Index, the United Nations Development Programme ranked Mozambique 180 out of 189 qualifying countries. This lack of development is experienced at a household and community level through a diversity of deprivations, including lack of access to water, energy and food. These deprivations are experienced more acutely in rural areas such as the district of Nhamatanda, Sofala Province, Mozambique where only 50% of people have access to clean water, close to 40% of children suffer from stunting and malnutrition and only five percent have access to electricity (INE 2017). To address these critical needs, innovative, flexible and results based projects are needed that are locally relevant, ecologically sustainable and economically viable. In order to secure minimum access to these vital resources, and also contribute to more flourishing futures for rural communities, these projects need to build local livelihoods and enhance longer term ecological governance.

This thesis and research endeavour explores one promising hybrid model by integrating insights from water-energy-food nexus theory, the sustainable livelihoods approach and adaptive comanagement. Integrating these insights and utilising a community based participatory action research process, the aim of the research was to collaboratively collect socio-ecological data with the community of Nguinea, Nhamatanda District and subsequently use that data to design a meaningful Logical Framework Matrix project proposal. The research design deployed a mixed methods approach that sought to quantify the socio-ecological flows of a local community demonstration farm, analyse local market dynamics and foster more qualitative data collection and feedback through focus groups and informal interviews.

During the research process Cyclone Idai ravaged the research site and provoked a devastating humanitarian crisis. To respond to this crisis and building off the Logical Framework Matrix as a flexible prototype for project planning, the research adapted its methodology to address the immediate needs stemming from the cyclone, while also collecting critical data and feedback needed to develop a project proposal. The results of the research is a five year project proposal aimed at enhancing access to water, energy and food by cultivating and supporting local livelihoods. The proposed project's initial activities are focused on building the capacity of the local community through practical agroecology training programmes and equipping two local manual borehole drilling teams. Building on the knowledge and skills gained from these initial capacity building activities, the project then shifts to fostering the capability of the community to extend and apply these skills in meaningful and locally adapted ways. Specifically, this will be accomplished through an agroecology farmer extension programme, a community borehole drilling campaign, an agroforestry community outreach initiative, horizontal integration of local farmers and local leadership development. Ultimately, the goal of the project is to build a bridge between theory and practice of community based natural resource management by fostering a locally relevant form of adaptive comanagement that enhances access to water, energy and food while also contributing to generative livelihood outcomes.

Opsomming

Mosambiek is een van die armste en mins ontwikkelde lande ter wêreld. Die Verenigde Nasies se Ontwikkelingsprogram het dié land in 2019 in die 180ste plek uit 189 kwalifiserende lande op die indeks van menslike ontwikkeling geplaas. Hierdie gebrek aan ontwikkeling lei tot verskeie ontberings op sowel huishoudelike as gemeenskapsvlak, waaronder 'n tekort aan water, energie en voedsel. Landelike omgewings soos die distrik Nhamatanda in die Mosambiekse provinsie Sofala word swaarder deur hierdie ontberings getref. Hier het slegs 50% van mense toegang tot skoon water, ly nagenoeg 40% van kinders aan belemmerde groei en wanvoeding, en het slegs 5% toegang tot elektrisiteit (INE 2017). Om in hierdie dringende behoeftes te voorsien, word innoverende, buigsame en resultaatgebaseerde projekte vereis wat plaaslik relevant, ekologies volhoubaar en ekonomies lewensvatbaar is. Om minimum toegang tot hierdie noodsaaklike hulpbronne te verseker, en ook tot 'n voorspoediger toekoms vir landelike gemeenskappe by te dra, moet hierdie projekte plaaslike bestaansmiddele bou en ekologiese bestuur op die lange duur versterk.

Hierdie tesis en navorsingspoging verken een belowende hibridiese model deur insigte uit die teorie oor die water-energie-voedsel-neksus, die volhoubarebestaansbenadering en aanpasbare medebestuur te integreer. Die navorsing maak van 'n gemeenskapsgebaseerde deelnemende aksienavorsingsproses gebruik om in samewerking met die gemeenskap van Nguinea in die distrik Nhamatanda sosio-ekologiese data in te samel. Dié data word dan gebruik om 'n sinvolle voorgestelde projek binne die logiese raamwerkmatriks te ontwerp. Wat navorsingsontwerp betref, word gemengde metodes gebruik om die sosio-ekologiese vloei van 'n plaaslike gemeenskapsdemonstrasieplaas te kwantifiseer, plaaslike markdinamiek te ontleed, en deur middel van fokusgroepe en informele onderhoude meer kwalitatiewe data-insameling en terugvoer te bewerkstellig.

Sikloon Idai het in die loop van die studie verwoesting op die navorsingsterrein gesaai en 'n enorme humanitêre krisis tot gevolg gehad. Om op hierdie krisis te reageer én op die logiese raamwerkmatriks as 'n buigsame prototipe vir projekbeplanning voort te bou, is die navorsingsmetodologie flink aangepas om in die onmiddellike behoeftes ná die sikloon te voorsien, en terselfdertyd noodsaaklike data en terugvoer vir die projekvoorstel in te samel. Die resultaat van die navorsing is 'n projekvoorstel vir vyf jaar wat beoog om toegang tot water, energie en voedsel te verbeter deur plaaslike bestaansmiddele te skep en te ondersteun. Die aanvanklike aktiwiteite van die voorgestelde projek konsentreer daarop om die plaaslike gemeenskap se vermoë deur praktiese agro-ekologie-opleiding te bou en twee plaaslike spanne toe te rus om boorgate met die hand te grawe. Op grond van die kennis en vaardighede wat uit hierdie aanvanklike vermoëbouaktiwiteite bekom word, verskuif die klem dan daarna om die gemeenskap in staat te stel om hulle nuwe vaardighede op sinvolle en plaaslik relevante maniere oor te dra en toe te pas. Dít sal spesifiek bereik word deur 'n agro-ekologie-landbouvoorligtingsprogram, 'n veldtog oor gemeenskapsboorgate, 'n gemeenskapsuitreik inisiatief in die agrobosboubedryf, horisontale integrasie van plaaslike boere, en plaaslike leierskapsontwikkeling. Die einddoel van die projek is om 'n brug tussen die teorie en praktyk van gemeenskapsgebaseerde

natuurlikehulpbronbestuur te bou deur 'n plaaslik relevante vorm van aanpasbare medebestuur te skep wat toegang tot water, energie en voedsel verbeter, terwyl dit ook tot produktiewe bestaansuitkomste bydra.

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This MPhil thesis has been a five year journey which started in 2016 when I first enrolled at the Sustainability Institute. Over the last five years there are so many people I could thank for their support and guidance. That being said there are a few people who stand out that I want to specifically acknowledge and say thank you.

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List of Acronyms and Abbreviations

ACM	Adaptative Comanagement
CBO	Community Based Organisation
CBPAR	Community Based Participatory Action Research
EIA	Ecological Impact Assessment (or Environmental Impact Assessment)
ELS	Environmental Livelihood Security
FAO	Food and Agriculture Organisation (of the United Nations)
FRELIMO	Frente de Libertação de Moçambique (Liberation Movement for the Freedom of Mozambique)
IFAD	International Fund for Agricultural Development
INE	Instituto Nacional de Estatística (National Institute of Statistics)
IWRM	Integrated Water Resource Management
LDCN	Local Development Catalyst Network
LFA	Logical Framework Approach
LFM	Logical Framework Matrix
MDG	Millennium Development Goal
MDP	Multidimensional Poverty
MLI	Multidimensional Livelihoods Index
NPO	Non-profit Organisation
RENAMO	Resistência Nacional Moçambicana (Mozambican National Resistance)
SDG	Sustainable Development Goal
SLA	Sustainable Livelihoods Approach
TDR	Transdisciplinary Research
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USA	United States of America
WEF	Water – Energy – Food
WEIA	Women's Empowerment in Agriculture Index
WFP	World Food Programme
WHO	World Health Organisation

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1. Chapter 1 – Introduction

1.1. Introduction

One of the most persistent and urgent needs the world faces is the securing of safe and sustainable access to water, food and energy. Currently, two billion people lack regular access to nutritious and sufficient food, 900 million lack access to clean water and 1.5 billion have no source of electricity (Schlör, Venghaus, Fisher, Märker & Hake 2018; FAO, IFAD, UNICEF, WFP & WHO 2020). These three basic needs are fundamental not only to securing the basic human rights and dignities of people around the world but also to unlocking new and important opportunities for more equitable and sustainable development. However, despite the widespread recognition of the critical and urgent need to provide safe and sustainable access to these essential resources, meaningful progress towards these goals continues to be mired by a complexity of challenges, pressures and constraints (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs, Bruce, Boruff, Duncan, Horsley, et al. 2015a; Kurian 2017; Aboelnga, Khalifa, McNamara, Ribbe & Sycz 2018; Bleischwitz, Spataru, VanDeveer, Obersteiner, van der Voet, et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang, Chen, Li, Ding & Fu 2018).

In a 2009 speech, Sir John Beddington, the United Kingdom Government Chief Scientist, described this complexity of challenges as a ‘perfect storm’ of factors that threaten the world’s ability to provide efficient and sustainable access to essential finite natural resources (Schlör et al. 2018). On the one hand, global demand will rise due to a number of socio-economic trends: global population is expected to grow by 1 billion people by 2030 and this population growth will be coupled with changing global demographics; increased economic growth; and more resource intensive lifestyles (Bleischwitz et al. 2018; Ghodsvalli, Krishnamurthy & de Vries 2019; Messerli, Murniningtyas, Eloundou-Enyegue, Foli, Furman, et al. 2019; World Economic Forum 2020). As the global population continues to grow, people will continue to migrate towards urban centres in search of greater prosperity and economic opportunities (Hoff 2011; Aboelnga et al. 2018). This increasingly urban population will subsequently contribute to global economic growth that in turn will foster a burgeoning middle class (Hoff 2011; Aboelnga et al. 2018). Ultimately, the increasing prosperity of this growing middle class will lead to more resource intensive diets and lifestyle choices thereby increasing demand for essential natural resources (Ringler, Bhaduri & Lawford 2013; Schlör et al. 2018). As Schlör et al. (2018) point out, by 2030 global demand for water is expected to grow by 30 to 40 percent, demand for energy by 40 to 50 percent and demand for food by 35 to 50 percent.

On the other hand, further complicating these shifting and increasing socio-economic demands, are the increasing socio-ecological constraints and pressures on the supply of these essential resources (Rockström, Steffen, Noone, Persson, Chapin, et al. 2009; Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018). Earth’s natural resources are finite and continued unsustainable extraction and depletion will lead to greater shortages and eventual exhaustion of supply. Furthermore, these shortages in supply are not linear or

limited to specific locations or time frames. The impacts of climate change, the loss of important biodiversity and land degradation will only lead to greater vulnerability and volatility of the ecological systems and natural resources that underpin all of society (Rockström et al. 2009; Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018). These impacts can be seen in more frequent and stronger weather events and natural disasters, permanent land change and shifts in climatic patterns such as rainfall. As we push the carrying capacity and ecological thresholds that sustain human life, we also threaten the ecological conditions that allow humans to safely operate on the planet (Rockström et al. 2009; Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018; World Economic Forum 2020).

As we face these human driven ecological threats, we also face accompanying socio-economic threats such as poverty, inequality, weak institutions and poor governance (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018; Schlör et al. 2018; World Economic Forum 2020). The increasing costs of food, energy and water exacerbate global inequalities thereby contributing to civil unrest and potential social catastrophes (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018; Schlör et al. 2018). Conflict and war, largely driven by disputes over access to and control of natural resources, threaten millions of people worldwide (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018; Schlör et al. 2018; World Economic Forum 2020). Corruption, state capture and weak institutions aggravate unequal access and distribution of natural resources and suppress meaningful social change movements (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018; Schlör et al. 2018; World Economic Forum 2020). Finally, poor governance, a lack of capacity and ineffective policy all contribute to reductionist solutions that struggle to recognise and respond to these global challenges and furthermore inhibit potential game changing innovations (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018; Schlör et al. 2018).

In order to confront this impending ‘perfect storm’ and to mitigate its potential calamitous impact, world leaders developed a comprehensive set of 17 Sustainable Development Goals (SDGs) and 169 accompanying targets in 2014 (Weitz, Nilsson, & Davis 2014; Moore 2015). These goals were meant to build off the Millennium Development Goals (MDGs) in order to engage all countries, at all income levels, to foster and sustain the wellbeing of all people and the environment for current and future generations (Weitz, Nilsson, & Davis 2014). Zero Hunger (SDG 2), Clean Water and Sanitation (SDG 6) and Affordable and Clean Energy (SDG 7) were all identified as priority areas (Weitz, Nilsson, & Davis 2014; Bleischwitz et al. 2018; Schlör et al. 2018). However, if the promise of each of these individual goals is to be achieved, they cannot be approached and implemented in the same ineffective, sector specific and top down way the MDGs were implemented (Weitz, Nilsson, & Davis 2014; Moore 2015; Simpson & Jewitt 2019). Novel and innovative approaches that are able to bridge the divide between science, policy and implementation and to integrate knowledge from a diversity of stakeholders and perspectives are needed (Scott, Kurian & Westcoat Jr. 2015; Trimble & Plummer 2019; Ghodsvai, Krishnamurthy & de Vries 2019; Gevelt 2020).

This is not to suggest that robust sector specific inquiries and more expert driven contributions are not important. Rather, it is meant to suggest that these more traditional approaches need to be balanced and complemented by more integrative, inclusive and socially accountable approaches that cut across scales and sectors (Rogers et al. 2013; Vasseur, Horning, Thornbush, Cohen-Shacham, Andrade et al. 2017; Bleischwitz et al. 2018). By looking at the interlinkages, synergies and tradeoffs of different resource policies, more efficient and cost-effective solutions can emerge (Kurian 2017; Ghodsvali, Krishnamurthy & de Vries 2018, Zhang, Chen, Li, Ding & Fu 2018). By including and fostering dialogue amongst a greater diversity of stakeholders, fostering cooperative interactions and localising agendas, more resilient and collaborative alliances that also address meaningful real-world issues can evolve (Muro & Jeffrey 2008; Rogers et al. 2013; Berkes 2017; Ghodsvali, Krishnamurthy & de Vries 2018). Finally, by fostering cross scale linkages and interactions, nurturing innovation, and building capacity to respond to changes, more adaptive and opportunistic solutions can emerge and capitalise on windows of opportunity (Westley 2013; Butler, Suadnya, Yanuartati, Meharg, Wise, et al. 2016; van Breda & Swilling 2019).

A key priority for the SDGs is to find meaningful ways to operationalise these ideas, approaches and theories through projects, policies and actions that enhance wellbeing and promote prosperity. However, as Weitz, Nilsson, and Davis (2014:40) state, “Countries will face different trade-offs and synergies, emphasize different targets and find different ways to improve development outcomes. Thus, the targets can be seen as building blocks that each country will combine in its own way, balancing the needs for ensuring access to resources, efficiency, and sustainability to fit local context and capabilities.” As such, development workers, academics and policy makers need to collaborate and assemble constellations of locally relevant development approaches that address human needs while also minimising environmental tradeoffs and enhancing governance capacities and capabilities needed to sustain, adapt and adjust to current and future global socio-ecological fluctuations. Building on these needs, the following thesis is an exploration of one such constellation that integrates insights from a diversity of theories and approaches to fostering sustainable development. Furthermore, to demonstrate the operational potential of this more theoretical constellation, the research findings are applied through a project planning framework and presented as a five year project proposal for stimulating meaningful development on the SDGs in rural Mozambique.

The rest of this chapter contains, firstly, an introduction to my personal motivation for undertaking this research, and my involvement with the community in which it took place. This is followed by the problem statement and the research objectives developed to explore this. In section 1.5, I provide an overview of the research approach and methodology, and conclude with a chapter outline of the rest of this document.

1.2. Background and rationale for the study

As a young, motivated and social justice oriented 23-year-old, I moved from the United States of America (USA) to Mozambique in 2010 to participate in a one year volunteer programme there. However, over the course

of my volunteer year, I became increasingly frustrated with my volunteer organisation and the mainstream development system as a whole. It seemed as if there was a disconnect between the development needs of rural Africans and the development ‘industry’s’ response to those needs; rather than looking to build upon the strengths, assets and resources that sustain rural African communities, projects were designed as short-term ‘band-aids’ that created a ‘mirage’ of development. Projects claimed ‘success’ while quality of life in communities seemed to be deteriorating. Somehow, development had become an industry, and the human side of development was lost while natural resources continued to be pillaged.

It was within this context that I founded my own non-profit organisation, Local Development Catalyst Network (LDCN), in order to fund a grassroots community development project in Mozambique. Since 2011, I have lived and worked with the community of Ndeja, Mozambique (Nhamatanda District, Sofala Province), with the goal of searching for and demonstrating locally relevant, ecologically sustainable and economically viable solutions to the key challenges local people face on a daily basis. The current result of this continuous and ongoing process has been the development of a demonstration farm that models a local sized family farm (1 hectare) and holds the potential to not only address important local issues, such as improving food security, access to clean water and solar energy, but also to help foster meaningful local livelihoods.

Motivated by the challenge and the broader need for sustainable development, I began my studies at the Sustainability Institute, Stellenbosch University, South Africa to develop insight into the problematic nature of development approaches I had witnessed in Mozambique, and to learn more about how best to approach and scale my project. One body of literature that proved to be particularly useful is water – energy – food (WEF) nexus theory, which also seems to bear some interesting similarities to the manner in which LDCN’s demonstration project took shape. The origin of WEF nexus theory can be traced back to integrated water resource management (IWRM), which recognises the central role water plays and its complex interdependencies with other resource nodes such as energy and food (Hoff 2011; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018). As a result, early WEF nexus models tended to prioritise water as the central node of a multifaceted natural resource management strategy (Aboelnga et al. 2018). The overarching aim of a WEF nexus approach is to seek ways to enhance the efficiency and sustainability of the socio-ecological system by finding resource use synergies while simultaneously working to minimise potential negative impacts and unintended consequences by identifying and offsetting tradeoffs (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018).

The LDCN demonstration garden also started with a focus on water, as this was the most pressing need in a community reliant on seasonal rivers and open pit wells. Specifically, we started by learning about and testing a manual borehole drilling technique capable of drilling 20 metres deep and providing access to clean water. From this initial step, we proceeded to recognise the opportunities and connections that access to water had on

other important resources. For example, we installed a small solar panel pump system that pumped water into an elevated water tank. The water from this pump provided clean water for the ten to 15 families living in close proximity and, in addition, the surplus energy was stored and used for charging cell phones and providing light in the evening. Furthermore, due to the increased pumping capacity from the solar pump relative to a hand powered pump, we were able to pump sufficient water to irrigate a 1000 m² vegetable garden. Produce from the garden has been used for local consumption with the surplus being sold in local markets.

As WEF nexus theory has gained greater recognition, it has evolved by building on academic theory, rigorous scientific inquiry and meaningful collaborations across disciplines and resource nodes (Biggs et al. 2015; Kurian 2017; Aboelnga et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). Furthermore, its application and understanding has been applied to more macro level national, transnational and regional scales in order to help inform and design meaningful policy to secure essential resource node provision (Biggs et al. 2015; Kurian 2017; Aboelnga et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). As such it has developed into a promising model for natural resource management and sustainability that is promoted to aid policy, institutions and governments (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). However, a key gap still exists in the literature: how to apply WEF nexus theory at a community level in pursuit of sustainable bottom up nexus development projects that lead to an improved quality of life for community members and to long term sustainable ecosystem management (Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018).

1.3. Problem statement

In Mozambique, close to 70 percent of the population live in rural areas where there is a high prevalence of micronutrient deficiencies, chronic undernourishment and stunting in children (UNDP 2015). As of the last national census released in 2017, only 26 percent of rural families had access to clean water, and the majority of the population lived below the poverty line (INE 2017). Attaining these fundamental development needs is further complicated by the vulnerability of rural livelihoods due to their dependence on the productivity of the natural resource base, which is under increasing pressure both from global climate change and unsustainable local practices (Osbahr, Twyman, Adger & Thomas 2008; Egoh, O'Farrell, Charef, Gurney, Koellner, et al. 2012). These fundamental needs coalesce at the nexus of the food-energy-water or, in other words, the need to achieve food security as well as secure access to energy and clean water.

There is a significant need to design and develop locally relevant, ecologically sustainable and economically viable projects that can offer improved quality of life and sustainable livelihoods for both present and future generations. In order to more fully understand the impacts and implications of these projects, rigorous data, collected using a water-energy-food nexus lens, is needed to support the design of these projects in order to enhance efficiencies and synergies while minimising tradeoffs. To ensure that these projects address important

issues of equity and social justice and to help ensure that they will be successfully adopted and maintained by communities, the approach must be collaborative and must build local governance capacities and capabilities across a diversity of scales.

1.4. Research objectives

The overall objective of this research endeavour is to co-develop a practical nexus development project proposal with the community of Nguinea, Mozambique, that sustainably addresses SDG 2 Zero Hunger, SDG 6 Clean Water and Sanitation and SDG 7 Affordable and Clean Energy. More specifically my research objectives are:

1. To collaboratively quantify the key socio-ecological and economic inputs and outputs of LDCN's demonstration farm in Nguinea, Mozambique;
2. To engage with the local community and pilot a community extension programme to help inform a broader project roll out strategy, and to help foster local management capacity;
3. To develop a locally relevant, ecologically sustainable and cost-effective project proposal based on a logical framework approach that is attractive to funders; and
4. To foster the socio-ecological conditions needed for the emergence of an adaptive comanagement form of ecosystem governance that amplifies generative project outcomes while situating project activities within resource nexus thresholds.

1.5. Introduction to research design and methodology

In order to achieve the research objective of developing a practical nexus development project proposal with the community of Nguinea, Mozambique, I developed a unique research design that combined a logical framework approach (LFA) and community based participatory action research (CBPAR) methodology. The LFA, and its associated logical framework matrix (LFM), is one of the most widely accepted and common project proposal formats used by donors, funding organisations and governmental development agencies (Coleman 1987; Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). At its core, the LFA breaks down a project into its essential objectives and connects those objectives with the key outputs, activities and resources needed to achieve them (Coleman 1987; Hummelbrunner 2010). Indicators that can be objectively verified through monitoring and evaluation and data collection are then linked to these objectives to help ensure effective and transparent implementation and evaluation (Coleman 1987; Bakewell & Garbutt 2005). Finally, in order to identify potential obstacles and challenges during project implementation, the LFA integrates a risk assessment and highlights important assumptions that may prevent, hinder or affect the achievement of objectives as measured by the indicators (Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). Through this structured and rational analysis connecting development challenges with clear objectives, outputs, and activities which can be

measured and verified, a blueprint for project implementation and monitoring and evaluation is developed and presented in the LFM.

Whereas the LFA and LFM provide the scaffolding or structural framework, I utilised a community based participatory action research (CBPAR) methodology to inform and develop my research design and project proposal. Using a mixed methods approach that integrated qualitative and quantitative data collection, I engaged and worked directly with community members to develop, inform and justify the project proposal. The goal of the CBPAR process was to prototype and test solutions with community members, and subsequently reflect on outcomes and refine the project proposal based on our shared experiences and collective reflection. The goal of utilising a participatory action research approach was not only to foster and solicit community feedback and participation during the project planning phase, but also to develop an iterative, reflective and transformative research design (Mackenzie & Knipe 2006; Mertens 2007; Rogers et al. 2013; Kurian 2017).

1.6. Ethical Considerations

Using a CBPAR methodology to design and plan a community development project required actively engaging and working with a diversity of community stakeholders. To maintain ethical integrity throughout this more action oriented and transformative research process, I used the following procedures during the collection and storage of my data:

1. *Transparency* – I remained open and honest about my intentions and goals for the project through an ongoing community consultation process. Progress reports and quantitative data that was collaboratively collected with the community was made available and presented to the local community during community meetings.
2. *Consent* - All participants were given a choice to participate and assured they could decline to participate or walk away, without repercussions, at any given point during the research process. Formal participants signed a written consent form, that was written and explained in their preferred language (Portuguese, Chisena or Chindau), giving permission to be interviewed and observed during the research process.
3. *Anonymity* – All participants, in all forms of research, were guaranteed anonymity unless they explicitly declined this right on the written consent form. None of the participants indicated that anonymity was required, however, all notes were still stored on a password protected computer. All sensitive files and notes were deleted upon completing and submitting the results.

To ensure these values and procedures were maintained throughout the research process, I kept a personal journal to critically reflect on my own positioning in the research process and continually checked in with personal advisors and mentors whom provided a more subjective outside perspective on problematic tensions and concerns that arose during the research process. Finally, to balance and manage the expectations of

community members and participants, I relied on my more than ten years of experience of living and working with the local community and the informal terms of engagement I have developed with community members.

1.7. Chapters outline

Chapter 1 provides a brief introduction to the study by situating the research within the context of the Sustainable Development Goals and global socio-ecological challenges associated with ensuring safe and sustainable access to water, food and energy. From this global perspective, the introduction then shifts focus to the context specific research problem as well as my personal motivation and rationale for the study. Chapter one concludes by outlining the four core objectives of the study and an introduction to the research design and methodology used to achieve these objectives and complete the logical framework matrix and project proposal.

Chapter 2 introduces the Logical Framework Approach (LFA) and Logical Framework Matrix (LFM). One of the key objectives of this research endeavour is to present the research findings in a project proposal format that operationalises research findings, attracts funding and creates viable pathways towards implementation. The LFA, and its associated LFM, is a widely accepted project proposal format and provides an established structural framework and scaffolding for guiding and presenting research findings. Chapter 2 introduces the key components and principles that underpin the LFA and LFM and also discusses its relative strengths and weaknesses as a planning framework and approach for implementing project proposals.

Chapter 3 provides the academic grounding and theoretical foundation for the project proposal through a literature review. More specifically, Chapter 3 explores how and where three distinct bodies of literature, nexus theory, sustainable livelihoods approach and adaptive comanagement, intersect and complement each other. Whereas nexus theory provides a more top down technocratic lens for analysing the potential synergies and tradeoffs between different resource uses and policies, the sustainable livelihoods approach provides a more bottom-up perspective on how community members utilise these same natural resources as part of their livelihood strategies. Despite their distinct perspectives and approaches, nexus theory and sustainable livelihoods share important values and sufficient methodological similarities to allow for their integration. However, in order to facilitate this integration in ways that enhance and operationalise their collective strengths, a theoretical and practical bridge that is capable of negotiating and overcoming their relative incongruencies and deficiencies needs to be constructed. By emphasizing collaborative learning, cooperative interactions and localised interventions, adaptive comanagement (ACM) is one potential bridge that also serves as a promising strategy for more sustainable long-term governance of natural resources.

Chapter 4 dives deeper into the research paradigm and methodology of this study. It provides an in depth discussion of the research paradigm, research design and structural framework, research methodology, and, finally, the format for translating and presenting research findings into an LFM project proposal. Having discussed the relative strengths and weakness of the LFA and LFM in Chapter 2, the focus now shifts to how I

operationalised and adapted the LFA to develop the project proposal. My approach to using the LFA was to adopt a community based participatory action research (CBPAR) methodology to collect research findings and to inform the specific implementation strategy of the project proposal itself. This was achieved by developing a flexible research design that unfolded through the research process, evolved from and within the specific research setting, and utilised a mix of qualitative and quantitative research methods. Upon completing the research process, the research design framework that emerged from the research process was then integrated into the planning framework of the LFM. Two key structural adaptations were made to the vertical and horizontal logic in order to facilitate this integration and to more effectively present research findings in the LFM.

Chapters 5, 6 and 7 make up the complete project proposal. Using the completed Logical Framework Matrix (LFM) as a reference point, I present a five year project proposal aimed at improving WEF nexus security outcomes by enhancing local livelihoods and fostering the socio-ecological conditions needed for a more sustainable, adaptable and locally relevant form of ecosystems management to emerge.

Chapter 5 provides an introduction to the context and problem setting in which the project proposal will take place. This analysis of the problem setting seeks to situate the project proposal in the broader context of international development by elaborating on the location, socio-political history, socio-cultural demographics, governance structures and policies and the sustainable development context of where the project proposal will take place. The problem setting also includes a discussion on the more recent impact of Cyclone Idai and the organisational background and achievements of the implementing organisation, Local Development Catalyst Network (LDCN). Finally, Chapter 5 concludes by highlighting the enabling conditions, constraints, opportunities and limitations that emerged from the research process described in Chapter 4. These research results combined with insights from the literature review and LDCN's background and history in working in the proposed project location provide the foundation for the project proposal.

Chapter 6 builds on this foundation and describes the vertical logic of the project proposal. This starts with the executive summary, or vision, of the project and subsequently proceeds to present the complete Logical Framework Matrix (LFM). Using the LFM as a guide, Chapter 6 moves from the project vision to presenting the objectives and outcomes of the different stages of the project proposal. Finally, Chapter 6 concludes by providing a timeline and description of the proposed activities to achieve the objectives and outcomes.

Chapter 7 transitions from presenting the vertical logic, or implementation strategy, to describing the horizontal logic and the project proposal's unique approach to monitoring and evaluation. This approach builds off a multiple evidence based approach to connecting knowledge systems and participatory social learning in order to track and verify locally relevant indicators. This monitoring and evaluation process is guided by an evolving and unfolding set of guiding principles. It uses an ecological impact assessment (EIA) to set the ecological

thresholds and boundaries while using a multidimensional poverty (MDP) survey to determine where and how to ensure the fundamental and essential socio-economic foundation. In doing so, the monitoring and evaluation sets the safe and just boundaries from within which the project can explore a depth of possibilities for meaningful development.

Chapter 8 is the conclusion of the thesis and offers a broad reflection of both the research process and project planning process. In addition to articulating the implications and next steps for the research process, the conclusion is also a reflection of the personal process I undertook to write this thesis and to develop the project proposal. This reflection is not meant to provide any universal truths, but rather to share my personal story in the hope that it can offer some inspiration or insight into the messy reality and lived complexity of planning, implementing, monitoring and evaluating sustainable development projects.

2. Chapter 2 – Introduction to the logical framework approach (LFA)

2.1. Introduction

Two of the purported strengths of non-profit organisations (NPOs) and community-based organisations (CBOs) are their close relationships with community stakeholders and their ability to adapt to the complex and changing needs of a particular community (Golini, Landoni & Kalchschmidt 2017). As these organisations are often founded by community members or are deeply embedded in their community, they are ideally positioned to probe, sense and respond to community feedback loops (Snowden & Boone 2007). Despite their strengths, however, one of the weaknesses of these organisations tends to be their difficulty or inability to provide reliable and quantifiable evidence of the impact of their interventions (Golini, Landoni & Kalchschmidt 2017).

Although it is beyond the scope of this research endeavour to investigate this broad characterisation of NPOs and CBOs, this characterisation does provide an important insight into the broader perception of these organisations. Specifically, although NPOs and CBOs are important role players in the development system their impact can be limited by their inability to plan, monitor, evaluate and communicate the impacts and results of their activities. This limitation of NPOs and CBOs subsequently leads to a number of other challenges such as difficulties in accessing funding and developing external support and credibility.

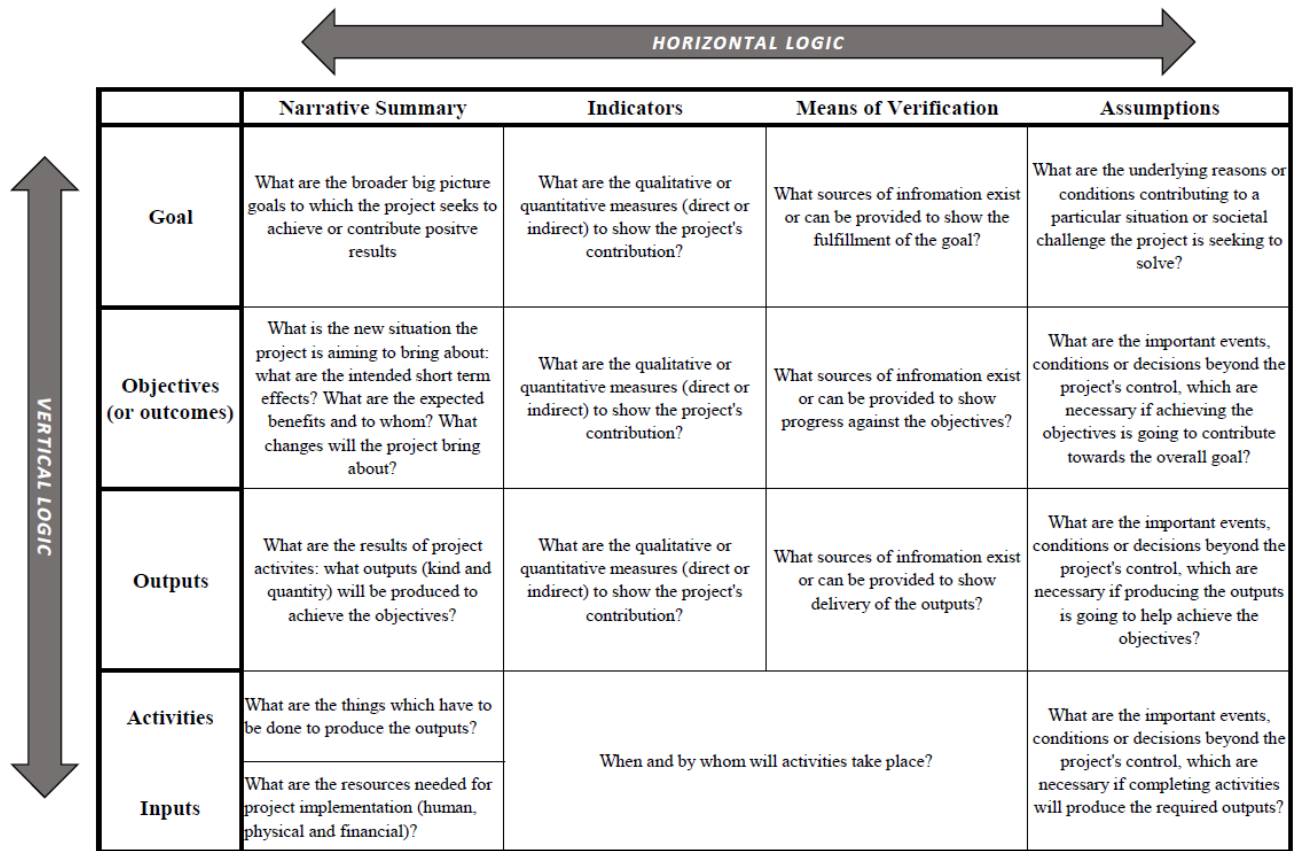
In order to address these limitations, donors and major role players in the international development field continue to promote and require the use of the logical framework approach (LFA) and logical framework matrix (LFM) for project planning and for monitoring and evaluation of development projects. As this research endeavour is focused on developing a project proposal for WEF nexus development and sustainable livelihoods at a community level, I will use the LFA and LFM to guide my research and to help overcome this limitation and characterisation of NPOs and CBOs. However, in order to effectively deploy the LFA and LFM, it is first important to understand both its strengths and shortcomings as a project planning framework.

2.2. Strengths of the logical framework approach

In addition to its long tradition in assisting project planning dating back to the 1960s, the LFA is also one of the primary planning approaches and requirements for funding by international development agencies (Coleman 1987; Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). The goal of using the LFA is to help planners break down a project into specific components and activities and connect them with key objectives and indicators used to monitor and evaluate a project (Coleman 1987; Hummelbrunner 2010). At the heart of the LFA is the LFM, which seeks to condense this information into a four by four matrix: the vertical axis (or vertical logic) identifies what a project will do and the horizontal axis (or horizontal logic) assesses how progress will be measured (including any external

factors that may impact achieving the desired goal/s) (Bakewell & Garbutt 2005). Table 1 describes the main components and key considerations of the LFM.

Table 1: Typical LFM format



The diagram illustrates the Logical Framework Method (LFM) format. A horizontal double-headed arrow at the top is labeled 'HORIZONTAL LOGIC'. A vertical double-headed arrow on the left is labeled 'VERTICAL LOGIC'. The table below is structured as follows:

	Narrative Summary	Indicators	Means of Verification	Assumptions
Goal	What are the broader big picture goals to which the project seeks to achieve or contribute positive results	What are the qualitative or quantitative measures (direct or indirect) to show the project's contribution?	What sources of information exist or can be provided to show the fulfillment of the goal?	What are the underlying reasons or conditions contributing to a particular situation or societal challenge the project is seeking to solve?
Objectives (or outcomes)	What is the new situation the project is aiming to bring about: what are the intended short term effects? What are the expected benefits and to whom? What changes will the project bring about?	What are the qualitative or quantitative measures (direct or indirect) to show the project's contribution?	What sources of information exist or can be provided to show progress against the objectives?	What are the important events, conditions or decisions beyond the project's control, which are necessary if achieving the objectives is going to contribute towards the overall goal?
Outputs	What are the results of project activities: what outputs (kind and quantity) will be produced to achieve the objectives?	What are the qualitative or quantitative measures (direct or indirect) to show the project's contribution?	What sources of information exist or can be provided to show delivery of the outputs?	What are the important events, conditions or decisions beyond the project's control, which are necessary if producing the outputs is going to help achieve the objectives?
Activities	What are the things which have to be done to produce the outputs?	When and by whom will activities take place?		What are the important events, conditions or decisions beyond the project's control, which are necessary if completing activities will produce the required outputs?
Inputs	What are the resources needed for project implementation (human, physical and financial)?			

Source: Adapted from Bakewell & Garbutt (2005)

The LFA has a number of key benefits in the project planning process as well as for the monitoring and evaluation of a project. As a formal procedure the LFA is rooted in the idea of results-based management and can assist project planners in identifying key objectives and activities of a project and its underlying goal or purpose (Coleman 1987; Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). It also helps identify the key inputs and outputs that are needed to achieve those objectives (Bakewell & Garbutt 2005). This forces a planner to think about the sequencing and hierarchy of objectives, what activities are needed to achieve those objectives and ultimately how to measure progress (Golini, Landoni & Kalchschmidt 2017). As Jacobs, Barnett and Ponsford (2010:37) state, “Logframes provide a short and convenient summary of a project, useful for internal and external communications. They simplify complex social situations and make them relatively easy to understand, linking budgets to actions and expected results”.

2.3. Weaknesses of the logical framework approach

Although the LFA can bring clarity, purpose, accountability and transparency to the project planning process, it is also subject to widespread criticism. At the heart of this criticism is its rigid, linear and reductionist approach to project planning (Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). The LFA assumes that complex social issues can be reduced and solved using linear logic thereby locking projects into path dependencies that reduce flexible implementation and diminish the importance of iterative learning processes (Bakewell & Garbutt 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). The LFA does not provide guidance on the technical means or the facilitation methods needed to collect data, achieve goals or optimise outcomes in locally relevant ways. As such, the LFA's cause and effect logic can be used to justify implementation strategies that recreate ineffective top down planning approaches. These criticisms of the logical framework approach can be applied to its vertical logic, to its horizontal logic and to its managerial use and implementation.

2.3.1. Vertical logic

The vertical axis of the Logical Framework Matrix (LFM) identifies the project's goals and what the project will do to achieve those goals (Coleman 1987; Hummelbrunner 2010). The vertical axis of the LFM, or the vertical logic, is thus a representation of the cause and effect analysis of the LFA. Despite its potential to bring clarity, to connect activities with desired outcomes, and ultimately to fulfil project goals and objectives, the vertical logic of the LFA and LFM is problematic for three primary reasons.

Firstly, there is potential for unclear linkages to arise across the different levels of the vertical logic (Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). Linking a higher order goal or purpose with shorter term objectives and outputs does not always follow a clear and condensed chain of cause and effect relationships. Furthermore, the LFM does not take into consideration the unintended consequences that may arise during project implementation (Jacobs, Barnett & Ponsford 2010). The degree of influence a project can exert on its desired outcomes and goals cannot always be clearly connected to the cause and effect logic and hierarchy of activities embedded in the LFM. External factors can limit or enhance a project's ability to achieve its intended results at all levels of the vertical logic. This can lead to overstating the causal linkages between different levels of the LFM, or to creating confusion as to what the project is responsible for and capable of achieving at each level of the vertical logic (Bakewell & Garbutt 2005; Golini, Landoni & Kalchschmidt 2017).

This confusion and difficulty of developing clear linkages and connections across different levels of the LFM can be exacerbated by the tendency to incorporate a diversity of different goals and activities into a specific level of the vertical framework analysis (Gasper 2000). This process of "jamming" as well as creating grand connections and linkages across the broad scale and scope of the vertical logic is problematic as it can distort

the reality of what the project will actually be doing and achieving at different stages of the project cycle (Gasper 2000:8).

Second, in creating a single chain connecting the means and ends of the project, the LFA and the LFM also fail to adequately embed the dimension of time and the diffusion of results and impacts over time (Gasper 2000; Harley 2005; Golini, Landoni & Kalchschmidt 2017). As Gasper (2000:15) notes, “The logframe struggles to describe slow, hard-to-schedule and recursive cause-effect links.” Short term and long term goals do not always fit on the same cause and effect chain, or means to an end timeline. They also do not always take place on the same linear pathway or trajectory (Harley 2005). The role and type of processes needed to implement or achieve goals that are dispersed over a long period of time are varied and do not always conveniently fit with short term goals and outputs of an LFA process (Golini, Landoni & Kalchschmidt 2017). This problem is particularly acute for projects that focus on short term objectives while at the same time seeking to develop longer term capacity and transformational change.

A third criticism of the vertical logic of the LFM is the potential to foster tunnel vision (Gasper 2000; Bakewell & Garbutt 2005; Harley 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). This can be seen in the tendency of planners to over value the cause and effect logic inherent in the LFM and to marginalise the assumptions and risks column. The vertical logic of the LFM assumes a certain amount of control to achieve project objectives by implementing specific activities that result in specific outputs or outcomes (Bakewell & Garbutt 2005; Hummelbrunner 2010). In doing so, the LFM emphasizes and reinforces a narrow and predetermined logic and implementation strategy of executing specific activities in order to reach a singular outcome (Harley 2005).

Compounding this narrow approach and tendency for tunnel vision is the relative lack of emphasis on developing a robust assumptions column. Structurally, there is no space within the LFM dedicated to developing indicators to monitor assumptions (or risks) or for developing alternative strategies or safeguards to address the potential negative impacts that may arise from these assumptions (Gasper 2000; Bakewell & Garbutt 2005; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). This structural deficiency inhibits a project’s ability to identify unintended consequences and important externalities, and, subsequently, to adapt its activities to take advantage of opportunities that arise from them.

Furthermore, as currently constructed, a nuanced analysis of assumptions, risks and outside influences can only be presented as part of the LFA in a way that highlights potentially disturbing incongruencies with the project’s underlying logic and implementation strategy (Gasper 2000; Harley 2005; Hummelbrunner 2010). Rather than inviting unwanted scrutiny, the assumptions column tends to be treated as a column for identifying uncontrollable (or unavoidable) externalities or for identifying assumptions that can be used as potential justifications for not meeting project objectives. Rather than fostering reflection and learning in an ongoing analysis of assumptions and risks, a superficial process of ‘fill in the blank’ assumptions tends to take place in

developing the LFM (Arkestijn, van Mierlo & Leeuwis 2015). Although skilled facilitators may be able to avoid this trapping, the vertical logic of the LFM tends to reduce and structurally avoid the messy reality of dealing with challenges that inevitably take place during project implementation and that arise from assumptions based on a precise and carefully constructed cause and effect logic.

2.3.2. Horizontal logic

While the vertical logic of the LFM is concerned with the cause and effect of implementing specific activities in order to achieve specific outputs and objectives, the horizontal logic is concerned with how to measure progress and evaluate a project's success (Coleman 1987; Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). It is primarily focused on developing meaningful indicators and a means to verify those indicators (Coleman 1987; Hummelbrunner 2010). Although monitoring and evaluating a project's interventions using indicators can both enhance accountability as well as help establish the efficacy and impact of a particular intervention, using a narrow lens that only emphasises the importance of specific indicators can also be problematic (Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). Reality is not always quantifiable or easy to measure and an overemphasis on evaluating success based on isolated indicators can distort reality and lock projects into a narrow and rigid trajectory of implementing predetermined plans (Gasper 2000; Harley 2005).

Another way the validity of indicators can be compromised is when they turn into targets (Gasper 2000; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). Rather than gauging and analysing the overall performance of a particular intervention and using indicators as a means to reflect and recognise where and how progress is being made and for whom, targets refer to specific and quantifiable results. Due to the complexity and difficulty of developing meaningful indicators, indicators are often substituted for easily identifiable and measurable targets in order to simplify monitoring and evaluation (Arkestijn, van Mierlo & Leeuwis 2015). Although targets may be applicable and useful for certain interventions and certain projects, the danger of developing targets is that they can foster a narrow approach to implementing and evaluating a project (Golini, Landoni & Kalchschmidt 2017). This can lead to tunnel vision in which achievement of the target becomes the priority rather than achievement of the larger goal or objective for which the project is designed (Jacobs, Barnett & Ponsford 2010; Arkestijn, van Mierlo & Leeuwis 2015).

This form of tunnel vision subsequently downgrades, prevents or excludes reflection and analysis of other positive or negative effects or factors that may indicate a change or impact on broader goals of a project (Arkestijn, van Mierlo & Leeuwis 2015). This becomes even more problematic when achieving a target is incentivised and thereby becomes a process of furthering the self-interest of a particular group or organisation (Gasper 2000; Harley 2005). This sort of manipulation of data can obscure declining standards, and be used as a justification for continued or increased funding despite deteriorating quality of a particular intervention.

Perhaps even more concerning is that it can corrupt and erode trust amongst stakeholders by manipulating reality.

2.3.3. Context and managerial use

These strengths and criticisms of the vertical and horizontal logic of the logical framework can be either exacerbated or overcome based on the context and managerial use of the LFA and the LFM. When used as archetype (or perfect model), the LFA risks succumbing to its more problematic tendencies, and this, in turn, can intensify its shortcomings while also reinforcing detrimental power asymmetries (Gasper 2000; Bakewell & Garbutt 2005; Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). This is particularly the case when the LFA is used as an all-encompassing, top-down, step-by-step process in which projects and interventions are designed for communities (Bakewell & Garbutt 2005; Golini, Landoni & Kalchschmidt 2017). In this more technocratic application of the LFA, community beneficiaries are seen as passive recipients of development, and success is based upon the effective implementation of carefully designed plans that deliver specific goods or services (Jacobs, Barnett & Ponsford 2010). Furthermore, success tends to be evaluated based on reaching target indicators that are measured by outside experts with technical skills needed to collect specific data (Golini, Landoni & Kalchschmidt 2017).

This mechanistic use of the LFA exacerbates the more rigid, reductionist and linear tendencies of the logical framework matrix and promotes strict enforcement based on specific rules and guidelines (Gasper 2000; Bakewell & Garbutt 2005). As an externally motivated project that is also externally evaluated, this use of the LFA can contribute to a disconnect with community stakeholder's needs, knowledge, values and skills. This can further confuse and aggravate already tenuous and unclear linkages between inputs, outputs, objectives and goals, especially when analysis of the risks and assumptions of the project are confined to the same narrow and linear implementation logic (Hummelbrunner 2010). The cumulative impact is that development becomes an empty process that does not value participation or reflection and inhibits learning.

In addition to these process driven shortcomings of the LFA, this more rigid use of the LFA and LFM can also reinforce power asymmetries. As a tool for donors to develop more results driven projects that are financially accountable, the goal of the LFA is to develop a clear cause and effect chain of activities and outputs that contribute to achieving and sustaining a broader goal (Bakewell & Garbutt 2005). Although accountability is essential in any project, by holding implementing organisations accountable to a predetermined plan set by donor organisations, accountability to community beneficiaries and stakeholders becomes a secondary consideration. Rather than encouraging participation and adapting plans and projects to stakeholders' needs, values and skills, implementing organisations are often tied to rigid terms of reference that prevent this flexibility and responsiveness (Gasper 2000; Golini, Landoni & Kalchschmidt 2017). This prioritises conformity to predetermined plans set by external donors rather than proactively responding to and addressing the needs of community stakeholders (Harley 2005). In this more rigid process, the pressure to achieve results

and claim observable effects further marginalises the needs and input of community stakeholders (Jacobs, Barnett & Ponsford 2010). This can lead to the erosion of trust of community stakeholders and reinforce an uneven and paternalistic form of development that helps ensure the dependency of community stakeholders on benevolent donor organisations (Gasper 2000; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017).

2.4. Conclusion

This rigid use of the LFA and LFM neglects the complexity of implementing development projects and can promote a design process that reinforces a more Western cause and effect approach. It can also increase uneven power structures, promote the needs and desires of donors, limit learning and reflection and inhibit flexibility and adaptability. Rather than bringing people together to achieve a common objective, this rigid misuse of the LFM can actually have the opposite effect and create larger divides and obstacles to development, foster mistrust, and further marginalise beneficiaries in the development process. Even more concerning is that these negative effects are often veiled behind the mirage of improved development statistics (target indicators) collected during project evaluation, thereby promoting business as usual in the international development industry.

However, just as the faults and limitations of the LFA and LFM can be exacerbated by the context and managerial use of them, the challenges can also be overcome and the benefits more fully realised through the skilled application of the LFA. By utilising the LFA and LFM as a prototype that can be adapted and shaped based on a project's and community's needs, a project planning process that bridges community oriented development with results driven evaluation can emerge. In doing so, the LFA and the LFM can contribute to the project planning process by providing clarity, accountability and definition of the short and long term goals of a project and how success will be measured in relation to those goals. Chapter 4 will discuss and describe how the LFA and LFM were used and adapted in this research endeavour to build on these strengths and while also fostering a locally relevant project planning process.

3. Chapter 3 – Literature review

3.1. Introduction

Currently, academic theories and sustainable development frameworks are adept at defining development challenges, critiquing development approaches and conceptualising theoretical trajectories towards fixed ideal future states (Lawhon & Murphy 2011; Rogers et al. 2013). Despite these strengths, however, there is still an uncomfortable gap between dealing with the lived complexity and practice of operationalising theory, translating science into policy, designing and implementing projects and, ultimately stimulating sustainable development outcomes (Simpson & Jewitt 2019; van Gevelt 2020). This challenge is particularly acute when dealing with a ‘wicked problem’; one that lacks a fixed solution due its multiple causes and the complex and interconnected set of factors that contribute to its persistent and constantly shifting nature (Dentoni, Hospes & Ross 2012; Wade, Grant, Karasaki, Smoak, Cwiertny, et al. 2020). Wicked problems are impossible to pin down and resist static, once off solutions (Daviter 2017; Dentoni, Bitzer & Schouten 2018).

Securing and managing safe and sustainable access to water, energy and food is one such wicked problem (van Gevelt 2020; Wade et al. 2020). Not only do future projections suggest growing socio-ecological constraints to the supply of these essential resources, but this is also coupled with a growing demand due to population growth and changing global demographics (Weitz, Nilsson & Davis 2014; Berkes 2017; Bleischwitz et al. 2018; Schlör et al. 2018; Ghodsvai, Krishnamurthy, de Vries 2019). These challenges around supply and demand are further complicated by the contested and political nature of access to these resources, by the diversity of stakeholders that have competing claims to these resources and by the complex web of power dynamics, institutional structures and cultural relationships within which access to these resources are negotiated (Nadasdy 2007; Cleaver & Whaley 2018; Schlör et al. 2018). And yet, despite these intractable obstacles, securing access to these life giving resources is a global imperative as represented by their inclusion and prominent role in the United Nations Sustainable Development Goals. The inherent question thus becomes how to approach, manage and implement meaningful projects that are capable of addressing these challenges thereby improving sustainable access and quality of life for marginalised communities.

Although there is no panacea to this question, there is an increasing recognition for the need to envision, develop and design innovative and transdisciplinary approaches that are able to integrate a diversity of perspectives and knowledge, adapt to shocks and shifting socio-ecological conditions and ultimately foster increasingly generative outcomes (Biggs, Westley & Carpenter 2010; Plummer, Crona, Armitage, Olsson, Teng ö & Yudina 2012; Biggs et al. 2015a; Kurian 2017; Ghodsvai, Krishnamurthy & de Vries 2019; Wade et al. 2020). These types of approaches require both a results driven orientation to achieve tangible and pragmatic outcomes and, perhaps more importantly, also require a focus on the process and strategy for implementation and longer term ecosystem management (Biggs et al. 2015b; Butler et al. 2016; Ghodsvai, Krishnamurthy & de Vries 2019).

Rather than applying a single framework, designing and implementing these types of innovative projects similarly necessitates developing meaningful and innovative constellations of theories, practices and perspectives. By drawing on a diversity of concepts, frameworks and methods, this process of ‘bricolage’, or assembling new and existing ideas and theories, can provide development planners and practitioners with a greater flexibility to adapt and develop locally relevant approaches that are more attuned to local contexts and can be more effectively translated into practice (Biggs, Westley & Carpenter 2010; Westley 2013; Cleaver 2018).

Stemming from this assertion, the focus of this literature review is geared towards building one such theoretical constellation equipped for addressing WEF nexus security in rural Mozambique. Specifically, I review, analyse and highlight concepts and insights from three bodies of literature: the WEF nexus approach, the sustainable livelihoods approach (SLA) and the adaptive comanagement (ACM) approach. Each body of literature has a unique perspective and approach to sustainable development and possesses relative strengths and weaknesses as a theory. WEF nexus theory provides a more top down technocratic sustainability lens for analysing the potential synergies and tradeoffs between different resource uses and policies. The sustainable livelihoods approach (SLA) provides a complementary bottom-up perspective on how community members utilise these same natural resources and other capital assets as part of their livelihood strategies. Finally, by emphasizing collaborative learning, cooperative interactions, and localised interventions, adaptive comanagement (ACM) offers a long-term natural resource governance strategy that has potential to connect bottom up and top down interests and perspectives. By integrating these three approaches, their collective whole offers a more robust, synergistic, and multifaceted approach that helps to offset their individual limitations, to reinforce their collective strengths and to foster a process driven approach capable of achieving tangible results on multiple timelines and scales.

In addition, this literature review provides a broad academic grounding for a sustainable development project proposal in rural Mozambique. The goal is to highlight specific insights and ideas from the literature that can contribute to the successful design, implementation, management and evaluation of the project proposal. These insights guided and broadly informed the principles, methodological choices and evaluation criteria for the research and project proposal. Finally, although this thesis and literature review is oriented towards developing a specific project proposal for sustainable development in rural Mozambique, my hope is that by reflecting and demonstrating how I translated theory into a real world project design, I can help close the gap between the theory and the practice of designing and implementing sustainable development projects. Perhaps this will also provide some insight into the conditions and processes needed to address wicked problems and promote sustainable development in other contexts and problem settings.

3.2. Water – Energy – Food (WEF) Nexus

Utilising a Water – Energy – Food (WEF) nexus lens to analyse and foster sustainable development has gained significant recognition and prominence since it was first introduced and promoted at the Bonn 2011 Conference aptly titled “The Water, Energy and Food Security Nexus – Solutions for the Green Economy” (Hoff 2011). The WEF nexus approach emerged from Integrated Water Resource Management (IWRM) which pioneered the idea of looking at both the competing as well as complementary uses of water across sectors and at a diversity of scales (ranging from a farm level to broader basin level) in order to enhance and inform water management practices and policies (Hoff 2011; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018). Building off this more holistic and interdisciplinary model of water management, WEF nexus theory expands on IWRM by explicitly including key additional resource nodes when analysing resource interdependencies and their subsequent impacts on different management strategies and development trajectories (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018).

Although there is considerable debate about which nodes should be included in a resource nexus approach, and, if there should be a central node, all resource nexus approaches include at least three principle nodes: water, energy and food (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). Using these three nodes as a starting point, the goal of a WEF nexus approach is to promote integrated resource management that reduce sectoral trade-offs and minimise negative unintended consequences, while identifying potential synergies that enhance the efficiency, productivity and sustainability of the broader system (Hoff 2011; Aboelnga et al. 2018; Zhang et al. 2018).

By focusing on synergies and taking a more systems level approach, WEF nexus theory recognises and values the importance of ecosystem services and their collective value to society (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). Ecosystem services are grouped into four primary categories: provisioning services (water, energy, food, etc), regulation services (carbon sequestration, purifying, etc), cultural services (recreation, education, spiritual, etc) and supporting services (nutrient cycling, purification, etc). As Vasseur et al. (2017:734) points out, they “represent the backbone of all current and potential economic, social, and cultural growths in any community – rural and urban.” This focus on ecosystem services and the diversity of ways they contribute to human well-being has prompted many academics, researchers and activists to advocate for a broader, more flexible and inclusive definition of the resource nexus that includes other important resources such as land, biomass and materials (Ringler, Bhaduri & Lawford 2013; Bleischwitz et al. 2018). This is in stark contrast to past management approaches which tended to focus on the productivity and efficiency of one sector or particular resource, oftentimes in detriment to the broader system.

This more systems oriented and synergistic analysis also breaks from past approaches in that it also lends itself to analysing how and where institutional relationships and governance structures intersect with the WEF nexus (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). Of particular interest in a WEF nexus approach is how resources are regulated, at what scale and through what type of institutional arrangements (Kurian 2017; Shannak, Mabrey & Vittorio 2018). In shedding light on the diversity of horizontal and vertical linkages that impact the WEF nexus, opportunities for cross sectoral collaboration and information sharing between stakeholders that span science, civil society and policy becomes possible (Hoff 2011; Biggs et al. 2015a; Zhang et al. 2018). These sorts of synergistic relationships can contribute to developing more robust data to inform policy that promotes more efficient and sustainable resource use. Furthermore, these sorts of WEF nexus networks better position policy makers to take advantage of windows of opportunity to amplify and accelerate effective WEF nexus interventions at increasingly larger scales (Westley 2013; Kurian 2017; Bleischwitz et al. 2018).

While identifying synergies within the WEF nexus can shed light on potential opportunities, assets and collaborative relationships in order to promote more efficient, effective and sustainable resource use, identifying trade-offs can in turn help to highlight the inherent political and uneven nature of development as well as the risks and threats to different policy decisions and development pathways (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). This is an important contribution of WEF nexus theory as it recognises the negotiated nature of development and can help surface power dynamics and potential friction points in how data are analysed and subsequently acted upon (Biggs et al. 2015a; Kurian 2017). This recognition of the negotiated nature of resource governance further necessitates analysing the economic costs and benefits of different trajectories and who stands to benefit from those trajectories (Ringler, Bhaduri & Lawford 2013; Shannak, Mabrey & Vittorio 2018).

By integrating potential synergies and trade-offs in a systems level analysis that incorporates social, ecological and economic influences, nexus theory offers a promising and innovative shift from prior ineffective natural resource management and sustainable development approaches (Hoff 2011; Ringler, Bhaduri & Lawford 2013; Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Bleischwitz et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). WEF nexus theory, however, is still in its relative infancy and as such there are considerable opportunities for new and novel contributions. Of particular relevance and interest to this research is the lack of nexus development projects designed and implemented at a community level (Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). Currently, nexus literature is more focused on national, regional or landscape scale policy collaboration, such as a river basin, to foster more sustainable ecosystem management (Biggs et al. 2015a; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). However, how larger scale policy and theoretical frameworks translate into designing meaningful

community level projects is understudied (Biggs et al. 2015). Furthermore, insight into the lived complexity and experiential knowledge that comes with operationalising a community level nexus development project in a culturally relevant, ecologically sustainable and economically viable way are also essential to assisting and aiding development initiatives that are taking place on the ground (Biggs et al. 2015a; Kurian 2017; Aboelnga et al. 2018). To overcome this shortcoming, I also reviewed the sustainable livelihoods approach (SLA), which is presented in the following section.

3.3. Sustainable livelihoods approach (SLA)

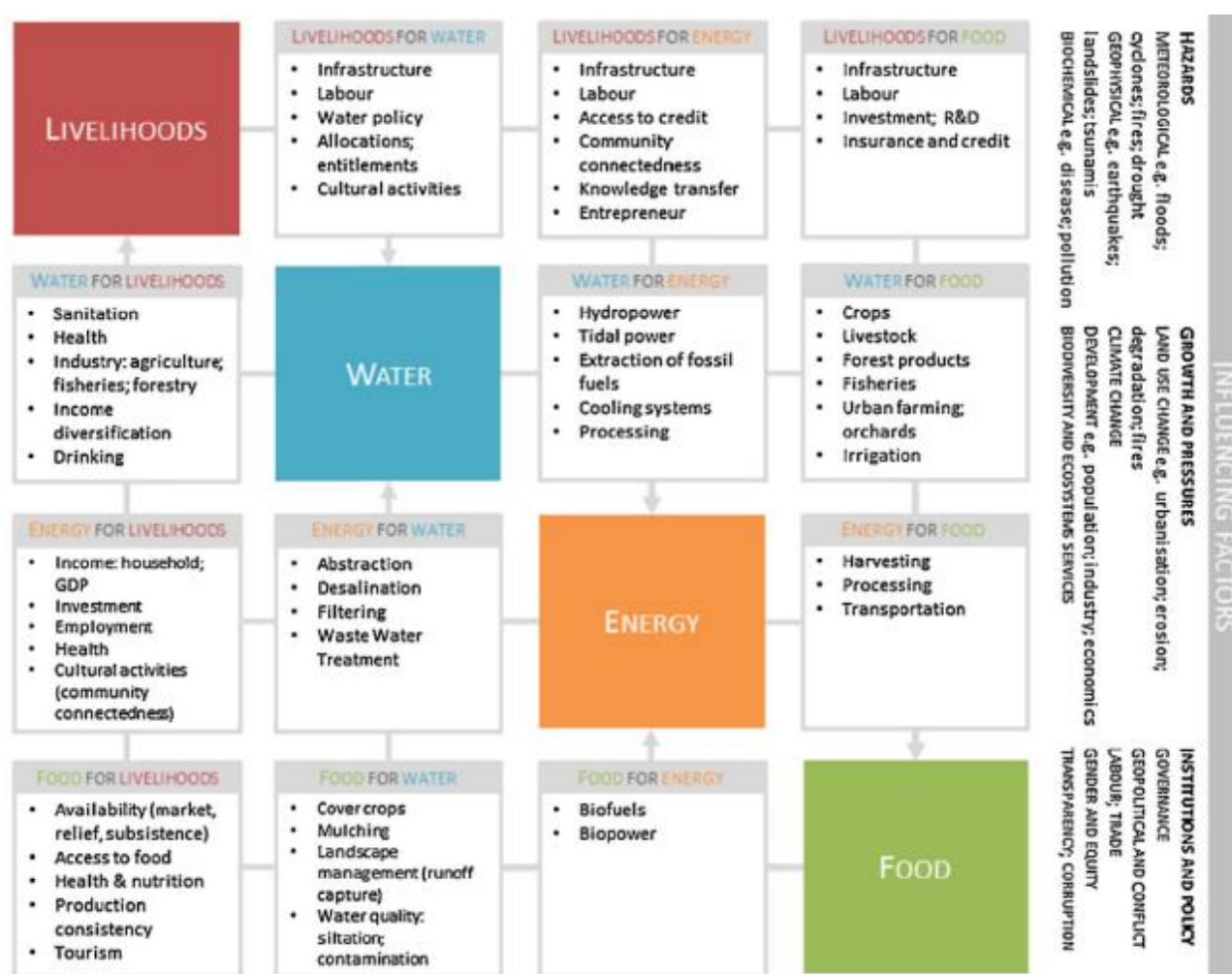
Despite their seemingly distinct approach to sustainable development, the sustainable livelihoods approach (SLA) and the WEF nexus approach are potentially complementary theories. By seeking to improve sustainable and safe access to water, energy and food, one of the overarching goals of WEF nexus theory is to address the underlying conditions that contribute to the persistence of extreme poverty (Biggs et al. 2015a; Shannak, Mabrey & Vittorio 2018). Addressing these underlying causes and eradicating extreme poverty is also the primary goal of the sustainable livelihoods approach (SLA) (Osbahr et al. 2008; Biggs et al. 2015a; Massoud, Issa, El-Fadel & Jamali 2016; Lundy & Adebayo 2016). However, whereas nexus theory tends to approach this goal using technical assessments and through top down formal institutions collaborating at a broader landscape, national or transnational level, the SLA seeks to address extreme poverty through a more people centred, bottom-up, community level analysis and interventions (Osbahr et al. 2008; Biggs et al. 2015a; Massoud et al. 2016).

At the core of the SLA is understanding how poor and marginalised rural communities live and secure their livelihoods, or, in other words, the diversity of ways in which they meet their short term and long-term needs (Brocklesby & Fisher 2003; Osbahr et al. 2008; Biggs et al. 2015a; Massoud et al. 2016; Lundy & Adebayo 2016). Using participatory processes, the SLA seeks to identify and understand the web of factors that inhibit or assist local livelihood strategies and how these factors are interrelated and acted upon (Osbahr et al. 2008; Massoud et al. 2016). The SLA recognises that different communities, as well as different households within those communities, have differing and varied access to key capital assets, also known as livelihood assets (Reed, Stringer, Dougill, Perkins, Athhopheng, et al. 2015; Lundy & Adebayo 2016). These assets are categorised into five main areas: human capital (health, education, knowledge and skills), financial capital (income, savings, credit), physical capital (infrastructure), social capital (social support networks) and natural capital (natural resources) (Brocklesby & Fisher 2003). Each of these forms of capital are vulnerable to a variety of trends, shocks and stressors that ultimately impact the security and stability of local livelihoods (Osbahr et al. 2008; Egoh et al. 2012). Ultimately, the goal of the SLA is to identify different ways to ensure and enhance access to key assets while designing locally relevant strategies to protect against potential threats (Reed et al. 2015; Biggs et al. 2015a; Lundy & Adebayo 2016).

Despite their seemingly contrasting approaches to addressing poverty, WEF nexus theory and the SLA have a number of synergies that allow for and facilitate their integration. Outside of their broad shared values of eradicating poverty and protecting essential ecosystem services, WEF nexus theory and the SLA also acknowledge and consider the socio-ecological pressures, context specific vulnerabilities, multilevel governance structures and range of stakeholders involved in promoting sustainable development (Rasul 2014; Biggs et al. 2015a; Shannak, Mabrey & Vittorio 2018). Although the WEF nexus literature has yet to fully explore the interlinkages with the SLA, a growing number of authors have started to recognise the opportunity to leverage these synergies for meaningful sustainable development (Rasul 2014; Biggs et al. 2015a; Shannak, Mabrey & Vittorio 2018). One relevant and promising hybrid approach is Biggs et al. (2015a) Environmental Livelihood Security (ELS) framework.

The ELS framework is an integrated approach to analysing the synergies and tradeoffs between WEF nexus nodes and how local people secure their livelihoods. As such, it seeks to balance and measure natural resource supply and human demand on the environment (Biggs et al. 2015a). In doing so, the goal of the ELS framework is to more effectively inform local environmental management while simultaneously finding and fostering more environmentally sustainable and locally relevant livelihoods (Biggs et al. 2015a). The ELS matrix (see Figure 1: Environmental livelihood security matrix) is particularly useful for development planning as it provides a framework to identify, organise and sort the specific linkages between WEF nexus resource nodes and the context specific livelihood opportunities within a particular context.

Although the synergies between the WEF nexus approach and the SLA allow for their integration, their differences in approach help complement and enhance each other's relative deficiencies. As previously stated, two weaknesses of current nexus theory are its more theoretical policy focus and its relative disconnect from community level development. By integrating the SLA into a nexus framework, it becomes possible to capture more bottom-up opportunities to enhance local livelihoods through sustainable nexus resource management at a more resource-user or local community level (Brockelsby & Fisher 2003; Osbahr et al. 2008; Biggs et al. 2015a; Reed et al. 2015; Massoud et al. 2016). Conversely, from an SLA perspective, one of its major limitations is that the SLA tends to be more a social science that depends on qualitative analysis and thus tends to lack scientifically sound quantitative data to support recommendations (Biggs et al. 2015a; Lundy & Adebayo 2016). Another major limitation is the SLA's inherent local focus and its relative inability to integrate broader geopolitical considerations, larger market forces and more wide-ranging environmental externalities such as climate change (Biggs et al. 2015a; Massoud et al. 2016; Lundy & Adebayo 2016). These are all current strengths of nexus theory and thus would help balance the SLA's more local level focus thereby providing a more nuanced analysis.

Figure 1: Environmental livelihood security matrix

Source: Biggs et al. (2015)

By integrating WEF nexus analysis and the SLA, one could obtain a more robust, multiscalar view of nexus interactions and their ability to not only meet WEF nexus security needs but also to foster more sustainable local livelihoods (Biggs et al. 2015a; Reed et al. 2015). We have seen how a nexus approach can contribute to improving equitable, safe and sustainable access to water, energy and food while at the same time improving the efficiency, conservation and sustainable use of natural resources. We have also seen how the SLA can enhance WEF nexus theory by incorporating community level analysis and more explicitly embedding livelihood considerations and resource user perspectives. Perhaps more important, however, are the practical implications this more integrated approach has for designing and developing context specific community level projects that address the immediate livelihood needs of end users/stakeholders while safeguarding key ecosystem services. However, a key area missing from this discussion is how, by whom and at what scale this process is managed and governed in the long term.

3.4. Adaptive comanagement (ACM)

Although the WEF nexus literature does address governance issues, it tends to focus on enhancing larger scale governance and formal institutional arrangements through technical assessments (Kurian 2017; Shannak, Mabrey & Vittorio 2018; Zhang et al. 2018). The SLA also recognises the importance of governance but approaches natural resource management through a focus on how livelihood activities and their associated forms of capital impact a local ecosystem (Brocklesby & Fisher 2003; Reed et al. 2015; Biggs et al. 2015a; Massoud et al. 2016; Lundy & Adebayo 2016). In both cases, the objective of the analysis is more informative in nature and does not explicitly address the processes or structures needed for sustainable ecosystem governance. In order to facilitate a convergence in their diversity, a long term governance framework capable of synthesising, negotiating and integrating the WEF nexus and SLA is needed. Adaptive comanagement (ACM) is one such ecosystem governance approach that holds the potential to build a theoretical and practical bridge to connect and operationalise the WEF nexus and the SLA in meaningful and locally relevant ways.

Ecosystem governance can broadly be understood as a collection of integrated resource management approaches that combine social, economic and ecological considerations through a diversity of formal and informal processes, structures and traditions that define how decisions are made and enacted regarding the wellbeing of people and the environment (Biggs, Westley & Carpenter 2010; Biggs et al. 2015b; Vasseur et al. 2017). The goal of ecosystem governance is to ensure the safe, equitable and long term provision of key ecosystem services in order to foster meaningful sustainable development (Reed et al. 2015; Vasseur et al. 2017). As such, ecosystem governance recognises the need to integrate and to find a healthy balance between social and ecological systems in order to sustain life on our planet. To achieve this balance, there is a growing recognition of the need for more integrated, responsive, adaptive and collaborative approaches that guide socio-ecological systems towards environmentally sustainable trajectories and that also promote inclusive, just and generative socio-economic outcomes for communities (Biggs, Westley & Carpenter 2010; Rogers et al. 2013; Westley 2013; Biggs et al. 2015b; Bleischwitz et al. 2018; Ghodsvalli, Krishnamurthy & de Vries 2019).

For ecosystem governance to be effective, the subsidiary principle posits that decisions, rules and actions need to be implemented and held accountable at the lowest appropriate governance level (Vasseur et al. 2017). However, simultaneously this more localised accountability needs to respect and meet broader acceptable minimum standards such that localised interventions, actions and policies do not infringe, limit or negatively impose constraints for sustainability at other spatiotemporal scales or locations (Biggs et al. 2015b; Vasseur 2017). As such, stakeholders and institutions are suited for different purposes and roles within socio-ecological systems and possess comparative advantages based on the scale and scope of where they operate (Berkes 2009; Vasseur et al. 2017). As Berkes (2009:1694) states, “Local institutions are best informed about the local level (e.g., state of local forests; livelihood needs of villagers), whereas the state has a regional and national vantage point and a repertoire of tools and techniques (e.g., scientific databases; remote sensing) not normally available

to local institutions.” Accordingly, effective ecosystem governance arrangements need to promote collective action based on legitimised knowledge that builds off of and is supported by a diversity of stakeholders operating at a diversity of scales.

In order to meet these elusive and difficult conditions, adaptive comanagement (ACM) has emerged as a relatively nascent yet promising ecosystem governance approach that combines the iterative learning function of adaptive management approaches with the linking function of comanagement approaches (Plummer et al. 2012; Fabricius & Currie 2015; Plummer et al. 2017a). Adaptive management is a flexible approach to natural resource management that fosters an iterative form of praxis that focuses on learning by doing, reflecting and refining activities through multiple cycles of learning that takes place over the medium to long term (Pahl-Wostl, Sendzimir, Jeffrey, Aerts, Berkamp & Cross 2007; Chaffin, Gosnell & Cosens 2014). This focus on learning by doing emphasizes the role of specialists and scientists to engage in experimentation to discover new knowledge that can help improve policy decisions and enhance resilience (Cleaver & Whaley 2018). Adaptive management, therefore, tends to place a greater value on technical assessments and deliberative processes that transcend the local scale and take place amongst experts and policy makers at the broader landscape, national and transnational scales (Chaffin, Gosnell & Cosens 2014; Cleaver & Whaley 2018). Accordingly, adaptive management depends on the capacity and relationships of managers, scientists and policy makers.

Conversely, comanagement or collaborative management has a much greater focus on building the capacity of resource users and communities to participate in and take responsibility for conservation and development (Berkes 2009; Plummer et al. 2012a; Fabricius & Currie 2015; Wyborn 2015; Plummer et al. 2017; Berkes 2018). The focus of collaborative management is thus more concerned with fostering legitimacy of conservation efforts through power sharing arrangements and the devolution of resource management to a more localised level (Plummer et al. 2012a; Vasseur et al. 2017; Berkes 2018). This necessitates a greater understanding of local social dynamics, contextual cultural norms and how community members access and utilise key ecosystems services for their livelihood strategies (Biggs et al 2015a; Cleaver & Whaley 2018; Williams, Crespo & Abu 2019). Perhaps most importantly though, is the importance of fostering and developing key horizontal and vertical linkages to facilitate communication, conflict resolution and negotiation of how local resources are managed amongst a diversity of stakeholders across a range of scales (Berkes 2009; Plummer et al. 2012a; Fabricius & Currie 2015; Wyborn 2015; Plummer et al. 2017; Berkes 2018).

By combining adaptive management and collaborative management, ACM is a hybrid approach. It builds on the benefits of collaborative management by integrating scale-specific comparative advantages, linking institutions and stakeholders at multiple scales, and negotiating context specific governance arrangements (Plummer et al. 2012a; Fabricius & Currie 2015; Wyborn 2015; Plummer et al. 2017; Berkes 2018). In doing so, ACM fosters a collaborative process that legitimises knowledge from a diversity of scales and stakeholders, enhances communication and conflict resolution, and emphasizes robust multi-faceted change networks

(Plummer et al. 2012a; Fabricius & Currie 2015; Butler et al. 2016; Trimble & Plummer 2019; Ariza-Montobbio & Cuví 2020). These benefits of a collaborative management approach are further enhanced in ACM by an ongoing problem-solving approach concentrated on practical trial and error experimentation that is more characteristic of adaptive management (Plummer et al. 2012a; Fabricius & Currie 2015). This practical experimentation produces tangible outputs and feedback that in turn stimulates a social learning process and collective reflection more attuned to addressing emergent and wicked challenges inherent in socio-ecological systems (Plummer et al. 2012a; Fabricius & Currie 2015; Biggs et al. 2015b; Berkes 2018). As Berkes (2009:1698) states, “adaptive management without collaboration lacks legitimacy, and co-management without learning-by-doing does not develop the ability to address emerging problems.” Therefore, the result of combining these two approaches is a dynamic process that produces responsive and flexible adaptation strategies and interventions that are context specific and are legitimised and supported across a diversity of scales and stakeholders.

Although ACM has a sound theoretical justification for its approach to ecosystem governance, when operationalising ACM, a number of challenges and problematic tensions arise. Four of these challenges that appear across the literature are:

1. Addressing power asymmetries;
2. Overcoming low stakeholder capacity;
3. Sustaining motivation; and
4. Dealing with limited time and/or resources.

Each of these challenges/problematic tensions is particularly relevant when operationalising an ACM process in a developing world context (Butler et al. 2016). These challenges are not unique to ACM, but rather are more a reflection of the wickedness of fostering ecosystem governance in complex social ecological systems characterised by inequality and limited human and financial capital. Although the literature addressing these challenges continues to grow, ACM is still a relatively nascent theory that is characterised by inconsistency and impression (Plummer et al. 2012; Butler et al. 2016; Chapman, Sullivan, Palm, Huynh, Diru, Masira 2016; Plummer et al. 2017a). To overcome such limitations and avoid becoming an ideological construct, ACM needs to reconcile its theoretical potential with its actual real world application. To do so requires deeper investigation into the context specific enabling conditions that can contribute to generative outcomes, and subsequently into how those enabling conditions can be integrated into the planning, implementation and evaluation of real world development projects. In the final section of this literature review, I will more deeply explore these enabling conditions and in doing so highlight how they can serve as a theoretical and practical governance bridge between the WEF nexus approach and the SLA.

3.5. Bridging the WEF nexus and SLA through an ACM approach

Having defined and established the theoretical underpinnings of ACM, the opportunity to bridge the WEF nexus approach and the SLA through an ACM approach becomes more clear. The WEF nexus approach tends to focus on promoting more sustainable natural resource use through more top down policy, informed by technical assessments and implemented through collaboration of formal institutions at a broader regional, national or transnational level. The SLA tends to focus on fostering sustainable development through bottom up initiatives aimed at enhancing access to key livelihood resources by working directly with communities and downstream resource users. Finally, ACM can serve as a bridge between these two approaches by fostering horizontal and vertical linkages that transcend scales, legitimising context specific knowledge, highlighting scale specific comparative advantages and promoting collaborative social learning. However, in order to move beyond merely identifying these theoretical synergies and complementary characteristics of the WEF nexus approach, the SLA and ACM, and instead, to integrate them in the lived practice of development planning and project implementation, requires a deeper analysis of context specific enabling conditions.

Despite recognising the fluid, negotiated and complex nature of reality, there is still a tendency to overly rely on theory in sustainable development planning and practice (Rogers et al. 2013; van Breda & Swilling 2019). Morin (2007:6) explains this frame of reference as a restrained complexity in which, “To some extent, one recognises complexity, but by decomplexifying it. In this way, the breach is opened, then one tries to clog it: the paradigm of classical science remains, only fissured.” In doing so, much of the literature on sustainable development fails to adequately integrate a lived complexity into theory thereby leaving an uncomfortable gap between theory and practice (Morin 2007; Rogers et al. 2013). To help avoid this trap, a number of structural and process-oriented insights have emerged in the ACM literature to help guide real world implementation as well as to overcome the inherent challenges and limitations associated with the lived practice of operationalising theory. Of particular interest for integrating the WEF nexus approach, the SLA and ACM, are six enabling conditions that surface throughout the ACM literature. They include, but are not limited to, the following:

1. Start small and progressively expand the scope of activities to deal with increasing complexity;
2. Use a multiple evidence-based approach for decision making;
3. Build meaningful spaces for interaction;
4. Develop a learning architecture through participatory M & E;
5. Promote livelihood innovation and entrepreneurship to help incubate ACM; and
6. Foster leadership networks by supporting and building the capacity of emerging leaders, brokers and policy entrepreneurs.

Throughout the ACM literature there is a general recognition that ACM is a process that has varying levels of maturity (Fabricius & Currie 2015; Butler et al. 2016; Trimble & Plummer 2019). In early stage arrangements (low maturity), many of the necessary adaptive capacities and governance capacities are limited and thus need

nurturing for ACM to mature (Berkes 2009; Butler et al. 2016; Trimble & Plummer 2019). In order to prime and capacitate stakeholders it is advantageous to initiate and foster ACM activities from a more narrow and focused local resource issue around which support can be garnered and a common vision built (Berkes 2009; Trimble & Plummer 2019). As Berkes (2009:1699) states: “There is a practical and testable implication of this finding: a new co-management arrangement should start off by tackling small problems, and proceed through successive cycles by elaborating the knowledge base while building trust and learning.” By starting small and with a more incremental focus on fostering change and learning, stakeholders are able to gain confidence in the process and to develop trust in each other. From this foundation it then becomes possible to increasingly widen the scope, scale and number of actors in the ACM process, to deal with more complex issues and to foster more profound transformational change (Berkes 2009; Butler et al. 2016; Trimble & Plummer 2019).

As ACM matures and increasingly complex issues arise, a greater diversity of stakeholders and knowledge will therefore need to be integrated into decision making processes. In order to ensure that the decision making process gives value to this diversity of knowledge and experience, it is essential to emphasize the advantage of combining and coproducing knowledge in innovative ways (Muro & Jeffrey 2008; Biggs et al. 2015b; Howarth & Monasterolo 2017; Berkes 2018). This is not meant to suggest that all forms of knowledge are complementary. However, by utilising a multiple evidence based approach that seeks to give value to knowledge from diverse perspectives, a greater respect and awareness of how knowledge is conceived, co-produced and validated can be fostered (Berkes 2009; Biggs et al. 2015b; Howarth & Monasterolo 2017; Berkes 2018). Furthermore, by finding the synergies between different forms of knowledge and knowledge production, a more robust evidence based approach that legitimises knowledge and helps build consensus across a broader spectrum of stakeholders can be established (Berkes 2009; Biggs et al. 2015b; Howarth & Monasterolo 2017; Berkes 2018).

This multiple evidence based approach to knowledge production and decision making can be further enhanced by developing meaningful spaces of interaction for stakeholders. These spaces of interaction are essential for developing communities of practice and fostering co-productive adaptive capacities and governance capacities through collaborative learning (Berkes 2009; Hall & Fleishman 2010; Plummer et al. 2017b; Baird et al. 2018). These spaces of interaction can serve as demonstration sites or “living laboratories” where stakeholders can work together to experiment and test hypotheses, technological innovations and other innovative solutions to local challenges (Plummer et al. 2017b:81; Baird et al. 2018). They can also serve as spaces to build social capital amongst stakeholders and to develop support networks through face to face dialogue and conflict resolution (Berkes 2009; Hall & Fleishman 2010; Plummer et al. 2017b; Baird et al. 2018). In integrating and creating meaningful spaces of interaction within ACM governance, facilitators and adaptive comanagers can foster a collective sense making process through cooperative interactions to help build resilient alliances and adaptive capacity (Fabricius & Currie 2015; Baird et al. 2018; Berkes 2018; Ghodslavi, Krishnamurthy, de Vries 2019).

Central to all ACM governance approaches is the fostering of learning through iterative cycles of observation, planning, action and reflection (Plummer et al. 2012). Developing a participatory monitoring and evaluation process as part of a long-term ACM governance approach can help establish this learning architecture while at the same time nurturing the collaborative long term adaptive capacity essential to ACM (Chapman et al. 2016; Butler et al. 2016; Trimble & Plummer 2019). At the core of participatory monitoring and evaluation is the encouragement of stakeholder participation throughout the project lifecycle, from design to implementation, evaluation and redesign (Chapman et al. 2016; Butler et al. 2016; Trimble & Plummer 2019). Especially in early stage ACM arrangements (low maturity), this form of participatory evaluation can contribute to developing more locally relevant indicators thereby producing more pertinent monitoring data (Trimble & Plummer 2019). In enhancing the relevance of data, the ability to use and integrate it into a collaborative learning process is also enhanced. This learning process can further contribute to developing new capacities and skills, increasing cooperation and communication amongst stakeholders and fostering a more inclusive, cohesive and transparent ACM process (Chapman et al. 2016; Butler et al. 2016; Trimble & Plummer 2019). Finally, participatory evaluation can also help to rekindle and reinvigorate stagnant or dormant ACM initiatives (Butler et al. 2016; Trimble & Plummer 2019).

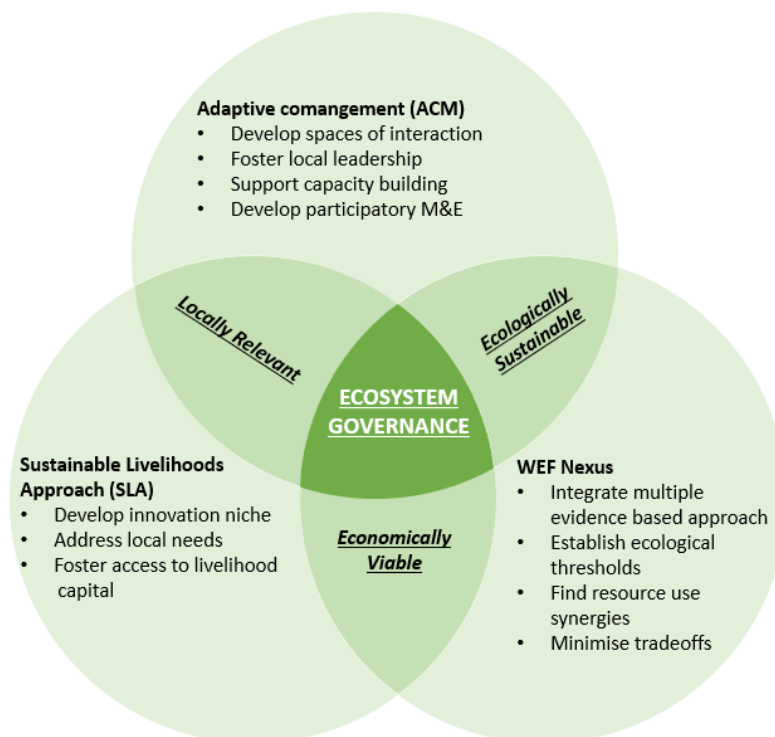
Fostering meaningful incentives and sustained motivation are key challenges for a long term ACM process. Incubating livelihood innovation niches can help to address this challenge by developing innovative solutions to address local needs (Biggs, Westley, Carpenter 2010; Butler et al. 2016:13; Wyborn 2015). When combined with participatory monitoring and evaluation and other ACM processes, improving access to key capital assets and working towards improved livelihood outcomes can help empower stakeholders and further develop individual and collective agency to participate in the ACM process (Wyborn 2015; Butler et al. 2016; Ariza-Montobbio & Cuví 2020). Furthermore, as Butler et al. (2016:13) points out, incubating livelihood innovation allows for “transformative practice to develop amongst more fluid and emergent rules, and without penalty for failure.” In fostering this transformative practice in livelihoods at a local level, this can help sow the seeds for stakeholders to capitalise on windows of opportunity for change in policy and institutional arrangements when they emerge (Westley 2013; Butler et al. 2016).

Finally, and essential to capitalising on windows of opportunity, is the importance of supporting and developing the capacity of leaders, brokers and policy entrepreneurs at a diversity of scales (Westley 2013; Butler et al. 2016; Howarth & Monasterolo 2017). Windows of opportunity are inherently unpredictable and do not always materialise on regular or convenient timelines (Berkes 2009; Westley 2013; Butler et al. 2016). Supporting leaders and policy entrepreneurs at a diversity of scales can help bridge stakeholders to create change networks that are increasingly able to self-organise in a diversity of ways (Berkes 2009; Westley 2013; Biggs et al. 2015b; Butler et al. 2016). This sort of resilient and diverse network is subsequently better positioned to identify, catalyse and coalesce when a window of opportunity does emerge, and better equipped to broker new development pathways and institutional arrangements (Berkes 2009; Westley 2013; Butler et al. 2016).

Rather than seeing these six enabling conditions as fully realised features of ACM, instead they can be seen as emergent properties of an evolving constellation of three broad sustainable development approaches: the WEF nexus approach, the SLA and ACM (see Figure 2: The intersection of ACM - SLA - WEF Nexus). Based on the unique interactions and context specific socio-ecological conditions in which they are set in the real world, these emergent properties can manifest, mutate and change in a diversity of ways. When seen from this perspective, these enabling conditions of ACM can be seen as a set of flexible and dynamic guiding principles for fostering a convergence in diversity between the WEF nexus approach, the SLA and ACM. Perhaps more importantly, they can also be used to build a practical methodological bridge between theory and practice.

Integrating a WEF nexus approach can support a multiple evidence based approach that enhances local community level planning and decision making surrounding key ecosystem services by setting broad ecological thresholds. Using an SLA can help incubate and develop a more bottom up livelihood innovation niche in order to foster and sustain motivation of community members/resource users while also addressing important local development needs. Finally, utilising an ACM approach can improve adaptive capacity and collaborative capacity by building meaningful spaces of interaction, fostering local leadership and developing a participatory monitoring and evaluation learning architecture. Ultimately, the goal of integrating these three approaches is to develop a locally relevant, ecologically sustainable and economically viable ecosystem governance approach equipped to help address the needs of rural Mozambican communities in the short and long term.

Figure 2: The intersection of ACM - SLA - WEF Nexus



Source: Author's own

3.6. Conclusion

As Biggs et al. (2015) reflect, “there are no ‘silver bullets’ for solving wicked problems; instead, addressing wicked problems requires decision making in the face of substantial uncertainty and combining multiple strategies that need to be constantly adjusted and adapted over time in an attempt to foster sustainable trajectories of change”. The focus of this literature review was to build one such constellation by combining three distinct sustainable development approaches: the WEF nexus approach, the sustainable livelihoods approach (SLA) and adaptive comanagement (ACM). The goal of this analysis was to demonstrate that despite their differences, a convergence of the WEF nexus approach, the SLA and ACM can help offset the relative weaknesses of each theory while reinforcing their individual and collective strengths. To achieve this goal, I reviewed each specific body of literature in order to highlight their theoretical underpinnings and approach to fostering sustainable development with a particular focus on finding the connections and synergies between each of the theories. Building off this analysis, I then identified and showed how six enabling conditions facilitated a convergence in diversity between these three distinct theories and provide a practical bridge between theory and practice.

What emerged from this analysis was a theoretically sound yet practically oriented ecosystem governance framework attuned and equipped to approach the wicked socio-ecological challenges rural Mozambican communities face. In addition to contributing to the development of this ecosystem governance framework, the insights and ideas that surfaced during the research process also provide the academic grounding for a sustainable development project proposal. Chapter 4 will extend these insights and analysis and demonstrate how this theoretical constellation of sustainable development approaches can be translated into a community based participatory action research (CBPAR) endeavour oriented towards developing a five year WEF nexus security and sustainable livelihood project in rural Mozambique.

4. Chapter 4 – Methodology

4.1. Introduction

Access to water, energy and food is a critical and urgent need in rural Mozambique. Developing local livelihoods and fostering a locally relevant form of ecosystem governance is essential to the long-term provision and sustainability of these essential services. However, achieving these goals is a complex and wicked challenge that has proven to be elusive for traditional top down, sectoral development approaches. Due to the persistent inability of development organisations to solve these challenges, there is a growing recognition/consensus for the need for innovative and emergent approaches that are able to adapt and shift to fluid socio-ecological dynamics through collaborative relationships and social learning (Virtanen 2005; Osbahr et al. 2008; Rogers et al. 2013; Biggs et al. 2015b). The goal of this research is to present and model one such approach that applies insights from the literature review, utilises a transformative research paradigm and builds on an LFA project planning process to collect data and build a meaningful project proposal. Whereas Chapter 3 highlighted key insights from the literature, the focus of Chapter 4 is to discuss the lens (section 4.2), the structure (section 4.3) and the methodology (section 4.4) and for integrating these insights into a unique LFM project proposal format (section 4.5). The goal of the research design is not only to address critical short term needs in the community of Nguinea, Mozambique, but also to develop a project planning model and a set of context specific guiding principles that contribute to the design of a broader long-term project proposal.

4.2. Research paradigm

4.2.1. Introduction – The transformative paradigm

The transformative paradigm is an overarching umbrella of research approaches used to combine academic inquiry with meaningful change-oriented action (Mackenzie & Knipe 2006; Mertens 2007; Romm 2015; Leavy 2017). It emerged from a number of critical oriented theories aimed at more explicitly embedding a human rights and social justice perspective towards addressing issues that affect marginalised people (Mackenzie & Knipe 2006; Leavy 2017). This axiological orientation towards social justice and human rights distinguishes the transformative paradigm from other research paradigms and necessitates a problem-solving approach to addressing societal challenges (Mertens 2007; Romm 2015).

Rather than seeing reality as a fixed state, the transformative paradigm sees reality as a socially constructed process (Mertens 2007; Romm 2015; Leavy 2017). As such, the world is in a state of becoming in which societal problems can be seen as open ended, situational and context specific (Mertens 2007; Romm 2015). Due to this more open-ended ontology, or understanding of reality, problems are social constructs that are embedded in our everyday actions and interactions (Freire 1989; Mertens 2007; Romm 2015). To overcome these problems, the transformative paradigm promotes an awareness building approach aimed at fostering critical reflection and meaningful action directed towards overcoming forms of oppression that manifest themselves in our everyday

realities (Freire 1989; Mertens 2007; Romm 2015; Leavy 2017). This form of praxis, or connecting action with critical reflection, results in what Freire (1989) calls ‘emancipatory knowledge’ and holds the potential to foster transformative outcomes.

As Freire (1989) also notes, this sort of emancipatory knowledge can only emerge when power disparities and oppressive structures are perceived as ‘limiting situations. One way the status quo is able to maintain its power is by asserting its role and privilege to produce knowledge while marginalising emancipatory knowledge stemming from experiences of the oppressed (Freire 1989). In doing so, the oppressive power structures of society are further embedded and the rigid, deterministic and more reductionist nature of the status quo continues to be reinforced (Freire 1989). In order to overcome this challenge, the transformative paradigm asserts the necessity of actively including marginalised populations in the research process rather than seeing them as objects of study (Mackenzie & Knipe 2006; Mertens 2007; Romm 2015; Leavy 2017).

This shift towards a more interactive approach, which respects culture and coproduces knowledge through collaborative relationships, is at the heart of the transformative paradigm epistemology (Mertens 2007; Romm 2015; Leavy 2017). It recognises that for emancipatory knowledge to reach its potential, it needs to be conceived of, acted upon and shared through generative relationships that overcome traditional power dynamics (Mezirow 1981; Freire 1989; Brown 2004; Mertens 2007; Rogers et al. 2013; Romm 2015). In doing so, a more collaborative process emerges, one in which social interactions validate, extend, and enhance praxis to give strength and meaning to insights and knowledge that are cocreated and discovered through the research process (Mertens 2007; Romm 2015; Wallerstein, Oetzel, Sanchez-Youngman, Boursaw, Dickson, et al. 2020). Furthermore, the way in which these social interactions promote diversity, inclusivity, and trust subsequently contribute to the transformative and instrumental potential of research findings (Romm 2015; Wallerstein et al. 2020).

In combining the axiological, ontological and epistemological elements of the transformative paradigm, a critical, collaborative and participatory problem-solving research paradigm emerges. It is one that seeks to transform and overcome oppressive structures in society in pursuit of more just and inclusive forms of sustainable development. Although the transformative paradigm does offer a broad ideological lens for research, it does not, however, provide clear direction on developing a methodology or choosing the appropriate methods for a given situation or research endeavour (Leavy 2017). Because of its relatively open and adaptable philosophy, there is considerable space for researchers to develop their own context specific methodology (Leavy 2017). Building on the flexible nature of the transformative paradigm, two research strategies that can provide insight into operationalising the transformative paradigm into practice are community based participatory action research (CBPAR) and transdisciplinary research (TDR).

4.2.2. Community based participatory action research (CBPAR)

Whereas the transformative paradigm is a broad umbrella for a diversity of change-oriented approaches to research, CBPAR is a research design strategy aimed at shaping and giving form to the relationships and processes needed to address a particular community problem (Leavy 2017; Wallerstein et al. 2020). Rather than providing a rigid methodology for research, CBPAR represents a more holistic lens to develop community engaged research that crucially emphasizes involving and developing partnerships with the “people whose lives are affected by the issue under study in every phase of the process” (Minkler 2000:192). In doing so, the line between researcher and participant is sufficiently blurred such that knowledge can be cocreated in the pursuit of addressing community needs and achieving community aspirations (Minkler 2000; Jull, Giles & Graham 2017). This in turn acknowledges the depth of experience, assets and knowledge that community members bring to the research process (Lazarus, Bulbulia, Taliep & Naidoo 2015). By ensuring community engagement from conception to implementation and evaluation, CBPAR empowers community members and promotes ownership in a development process that builds on community strengths and responds to community needs (Minkler 2000; Lazarus et al. 2015; Jull, Giles & Graham 2017; Leavy 2017; Wallerstein et al. 2020).

Due to its bottom up community orientation, CBPAR is highly contextual and therefore requires a flexible and adaptable definition and approach (Minkler 2000; Lazarus et al. 2015; Jull, Giles & Graham 2017; Leavy 2017; Wallerstein et al. 2020). Despite variations in the exact terminology used to define CBPAR, the approach stems from some generally accepted guiding principles (see Table 2: CBPAR design principles) (Leavy 2017). Building on these principles, CBPAR can be loosely defined as a flexible and innovative problem solving research approach in which researchers also act as community development facilitators, rely on a multiplicity of knowledge forms and develop collaborative and culturally sensitive community partnerships by recruiting and retaining community buy in, building trust and rapport with community members and taking a social justice orientation (Leavy 2017). The goal of CBPAR is to seek out and find ways to foster these principles through ground up, locally relevant and context specific methods (Lazarus et al. 2015; Jull, Giles & Graham 2017; Leavy 2017; Wallerstein et al. 2020).

An inherent assumption in this CBPAR definition, though, is an optimism in the ability to build trust and common understanding between different interest groups through a collaborative social learning process (Nadasdy 2007; Muro & Jeffrey 2008; Cleaver & Whaley 2018). This theoretical optimism in finding common ground and building consensus has not always translated into reality (Nadasdy 2007; Muro & Jeffrey 2008; Cleaver & Whaley 2018). Although a CBPAR lens and approach provides a useful starting point for developing a context specific methodology for conducting transformative research, a number of problematic tensions and key considerations arise when operationalising these principles in complex settings. More specifically, a CBPAR approach faces considerable tension during implementation in situations with culturally complex social dynamics marked by informality, inequality and limited human, financial and natural capital. This may be more

a reflection of the wicked nature of the situation rather than theoretical limitations of CBPAR itself, however that still does not disguise the need for greater attention to these complex contextual tensions. One research approach that complements CBPAR and provides operational insights into dealing with the wicked nature of these complex settings is transdisciplinary research (TDR).

Table 2: CBPAR design principles

Problem-Centred	Methodological strategies that best suit the research problem; often responsive designs that follow a recursive process
Collaboration	Deep collaboration between all research partners, clearly delineated division of labour, power sharing and mutually beneficial outcome
Cultural sensitivity	Community cultural definitions, understandings, norms and values are included and respected
Social action & social justice	Research is geared towards a community-identified need and will be used to create or initiate positive social change
Recruitment & retention	Good community buy-in is elicited and retained for the duration of the project by using culturally competent recruiting strategies
Trust & rapport	Trusting and egalitarian relationships built through power sharing, attention to insider-outsider statuses and demonstrating genuine caring/concern
Multiplicity	Different forms of knowledge - experiential, scientific, lay - are included and validated
Flexibility & innovation	Adaptation to emerging circumstances fostered by balancing structure and openness
Researcher skills	Development of researcher's organisational, facilitation and relational skills

Source: Adapted from Leavy (2017)

4.2.3. Transdisciplinary Research (TDR)

TDR falls under the umbrella of the transformative research paradigm and can broadly be understood as a research approach that goes beyond academic disciplines to engage a diversity of stakeholders to address complex real-world challenges (Jahn 2008; Kurian 2017; van Breda & Swilling 2019; Kurian 2017; Ghodslavi, Krishnamurthy & de Vries 2019; Trimble & Plummer 2019). The goal of TDR is to build a meaningful bridge between science and policy by coproducing relevant and practical knowledge to societal problems (Jahn 2008; van Breda & Swilling 2019). TDR emerged over the last two decades in response to the increasingly complex and hybrid nature of socio-ecological problems that lack a clear or singular cause and whose effects are

dispersed over time and space (Jahn 2008). As such, TDR seeks to address these problems as they manifest themselves in unique and context specific ways (Kurian 2017; van Breda & Swilling 2019; Ghodslavi, Krishnamurthy & de Vries 2019).

Clearly, a TDR approach shares a number of complementary and synergistic characteristics with CBPAR. Both seek to engage and include society during the research process. Both are oriented to dealing with real world problems through action-based research. Both seek to engage multiple stakeholders through participatory processes that are locally relevant and context dependent. However, despite these similarities there are four noteworthy characteristics that TDR emphasizes, thereby distinguishing it from CBPAR in subtle yet significant ways. They include:

1. A shift from a problem solving to problem setting orientation;
2. A focus on change as an inherently political and negotiated process;
3. A more nuanced and embodied understanding of complexity; and
4. A greater recognition of the role emergence can play in guiding process.

These characteristics are noteworthy not only because of their emphasis in TDR, but also because they offer important insights into how to activate a CBPAR process in problematic scenarios with significant tension around power, inequality and limited capacity. Whereas the transformative paradigm provides the lens for the research, and the CBPAR provides broad starting principles and methodological direction, TDR provides insights into addressing some of the tensions and challenges of implementing CBPAR. Collectively, they represent the point of departure from which to view the research design and methodology. I will revisit these characteristics of TDR in section 4.4 when I discuss how they guided the methodology and lived practice of implementing a CBPAR research design.

4.3. Research design – an LFA prototype

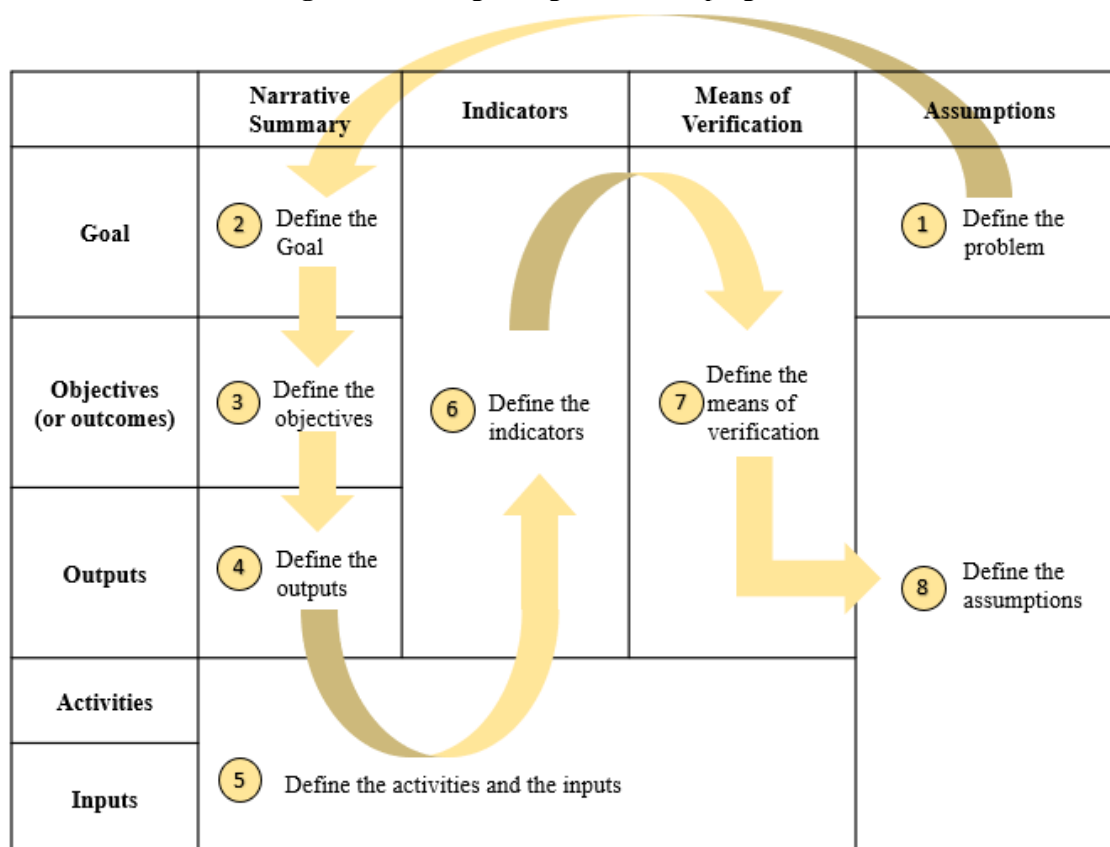
The primary goal of this research endeavour is to cocreate a project proposal with the community of Ndeja, Mozambique that seeks to improve access to water, energy and food by building local livelihoods and fostering the socio-ecological conditions needed for a more sustainable and locally relevant form of ecosystem governance to emerge. To achieve this goal, I built on the strengths of the LFA and LFM by using them as a flexible prototype and also integrated insights from the literature review and research paradigm. Whereas the LFA and LFM provided a loose structure and scaffolding for the research design, insights from the literature review and research paradigm helped to guide the research process as it unfolded. Ultimately, what emerged from this process was a unique research design (see Figure 4: Research design – the LFA as a flexible prototype) and an iterative and flexible project planning design flower (see Figure 5: Project planning design flower). For the remainder of this section (section 4.3), I will describe how I developed the unique research design and project planning design flower by building on the LFA and LFM as a flexible prototype. In the following section

(section 4.4) I will then describe how theoretical insights from the literature review and research paradigm helped to guide the lived practice of implementing an unfolding research process in the complex and dynamic research setting.

As the final output of the research process is to develop an LFM project proposal, the starting point for developing the research design is also reflective of and rooted in the LFA and LFM. An LFA mirrors the essential information needed to generate an LFM and has eight essential stages (see Figure 3: The eight stages of developing an LFM) (Bakewell & Garbutt 2005). The LFM is thus a condensed and succinct summary of these eight stages and describes the problem a project is designed to solve, how it intends to solve that problem (vertical logic), and how it will measure success/determine if the problem has been solved (horizontal logic) (Hummelbrunner 2010). In doing so, the LFA utilises a cause and effect logic to structure and sequence activities, and to develop meaningful indicators on which to track and measure progress (Bakewell & Garbutt 2005).

A normal LFA approach starts with the problem analysis and, subsequently, develops a vertical problem-solving logic to address the problem (Bakewell & Garbutt 2005). The vertical logic consists of defining the goal and objectives for solving the problem and then determining the outputs, inputs and activities needed to achieve the goal and objectives (Bakewell & Garbutt 2005). This vertical logic can then be confirmed through a cause and effect or by an ‘if...then’ questioning: If the inputs are available then the activities can be implemented; if the activities are implemented then the outputs will be produced; If the outputs are produced then the objectives can be reached; If the objectives are reached then the goal is achieved and the problem is solved (Coleman 1987). Having developed this cause and effect chain, the LFA then moves to develop the horizontal logic by linking the outputs, objectives and goals with indicators and the means of verification (Hummelbrunner 2010). The indicators serve as the benchmarks to ascend (or descend) from one level of the vertical logic to the next (Hummelbrunner 2010). Finally, the assumptions serve as the external factors, risks or inferences that may inhibit achieving the desired results thereby nullifying the vertical logic (Bakewell & Garbutt 2005; Hummelbrunner 2010).

From this point of departure, I reimagined each of the eight stages of the LFA to better reflect the goals, methods and activities of a CBPAR process. Whereas the LFM tends to use a more formal, rigid and top down linear planning process, a CBPAR process tends to promote a more collaborative, flexible and bottom up visioning process characterised by action and critical reflection. As such, I redefined each of the eight phases in LFM towards achieving my specific research goals through specific methods and activities (see Figure 4: Research design – the LFA as a flexible prototype). In doing so, I was able to integrate an engaged, dynamic and community oriented research process within the scaffolding of an LFA planning process.

Figure 3: The eight stages of developing an LFM

Source: Adapted from Bakewell & Garbutt (2005)

The initial phases of the research design (updating and framing phases) are designed to consider the role of the researcher and the unique problem setting of the research. I engaged in a number of activities aimed at reflecting on my past personal experiences with the community of Nguinea, as well as my principles and values regarding sustainable community development. I also defined the relative scale and scope of the research by collecting initial local sustainable development statistics and other relevant data.

The middle phases of the research design (exploring, deciding, experimenting and doing phases) are intended to be more collaborative in nature and aimed at stimulating feedback through direct interventions and community engagement. During these phases my goal was to develop a vision, set goals, formulate a strategy and implement my research methods and data collection activities with the local community. I collected initial data through a stakeholder analysis and rapid rural appraisal and subsequently developed a set of research objectives and methods. The envisioned methods and data collection activities were focused on collaboratively collecting a diversity of socio-ecological data through a mixed methods approach that combined qualitative and quantitative methods.

The final phases of the research design (evaluating and reflecting phases) are more focused on considering the results and impacts of activities and their short and long term implications. During these phases, I compiled the results of the research in order to collaboratively reflect on the data together with the community and direct

research participants. Building on this collaborative community reflection process, we defined a number of pragmatic next steps and started to develop the project proposal.

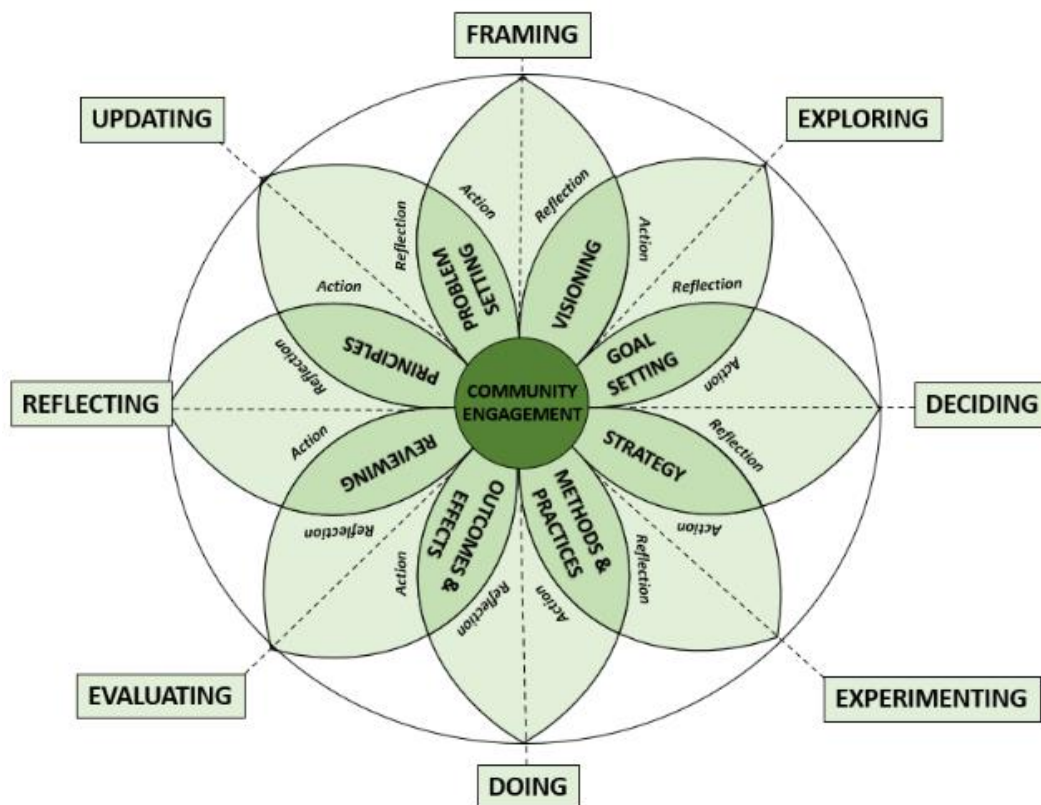
Figure 4: Research design – the LFA as a flexible prototype

LFA phase	Research paradigm	Research design phase	Research goals	Methods, activities & outputs
Define the problem	TRANSFORMATIVE RESEARCH PARADIGM COMMUNITY BASED PARTICIPATORY ACTION RESEARCH & TRANSDISCIPLINARY RESEARCH	Updating phase:	Reflect on principles & refine problem setting	<i>Reflect on experiences</i> <i>Review LDCN reports & newsletters</i> <i>Read personal journal</i> <i>Review LDCN mission, vision & values</i> <i>Decide Research Paradigm</i>
Define the goal		Framing phase:	Refine problem setting & develop a vision	<i>Set boundaries of research (scale & scope)</i> <i>Collect local sustainable development statistics</i> <i>Develop research problem statement and personal motivation</i>
Decide the objectives		Exploring phase:	Develop a vision & set goals	<i>Stakeholder Analysis</i> <i>Rapid Rural Appraisal focused on ELS framework</i> <i>Formulate research objectives</i>
Define the outputs		Deciding phase:	Set goals & formulate a strategy	<i>Select research methods</i>
Define the activities & inputs		Experimenting phase:	Formulate a strategy & initiate implementation	<i>Cyclone Idai emergency relief</i>
Define the indicators		Doing phase:	Continue implementation & monitor outcomes	<i>Resource flow analysis</i> <i>Demonstration farm</i> <i>Community transect walks</i> <i>Focus group</i> <i>Market analysis</i> <i>Cost benefit analysis</i> <i>Community meetings</i> <i>Coordinating with local leaders</i>
Define the means of verification		Evaluating phase:	Monitor & evaluate outcomes	<i>Develop pragmatic next steps with community</i>
Define the assumptions		Reflecting phase:	Evaluate outcomes & reflect on principles	<i>Compile the results</i> <i>Develop the project proposal/write thesis</i> <i>Literature Review</i>

Source: Author's own

In theory, the research design and an LFA planning process progresses sequentially through each of its eight phases. In reality, however, the lived complexity of implementing community based participatory action research unfolds in nonlinear ways. This was certainly the case in this research endeavour in which the research process jumped between, around and through all eight phases in ways that were reflective of the evolving socio-ecological dynamics and problem setting. In order to overcome the more rigid and linear nature of the LFM and to better reflect the dynamic nature of the research process, I reconceptualised the research design into a more iterative project planning design flower.

Figure 5: Project planning design flower



Source: Author's own

Like reality, the project planning design flower allows for a nonlinear implementation in which the research process progresses and flows through the different phases according to the real world context within which it is embedded. Furthermore, each phase, or pedal, of the project planning design flower overlaps and integrates an ongoing process of action and reflection. Finally, although the degree and level of community engagement shifted throughout the research process, to reflect its importance, the central feature, or stamen, of the project planning design flower is community engagement. Utilising this research design flower as a guide, in the following section I will reflect on how theoretical insights and the lived practice of implementing an CBPAR process played out in a dynamic, complex and unfolding research setting.

4.4. Research methodology – an unfolding research process

4.4.1. Research Timeline

The complete research took place over two years from September 2018 to September 2020 (see Table 3: Research Timeline) and can broadly be divided into three primary stages: the planning and preparation stage (September 2018 – March 2019); the implementation stage (March 2019 – January 2020); and the project proposal and thesis development stage (January 2020 – September 2020). Within these three broad stages, the research process progressed through each of the eight phases of the research design and project planning design flower. Although each of the phases are presented in sequential order, this is only intended to make them easier to grasp and to follow. In reality, the research process shifted between each of the research phases in an ongoing and iterative project planning process.

Table 3: Research timeline

Research Phase	Methods & Activities	TIMELINE																							
		2018				2019								2020											
		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Updating Phase: Reflect on principles & refine problem setting	Reflect on experiences																								
	Review LDCN annual reports & newsletters																								
	Read personal journal																								
	Review LDCN mission, vision & values																								
	Decide Research Paradigm																								
Framing Phase: Refine problem setting and develop a vision	Set boundaries of research (scale & scope)																								
	Collect local sustainable development statistics																								
	Develop research problem statement and personal motivation																								
Exploring Phase: Develop a vision & set goals	Stakeholder Analysis																								
	Rapid Rural Appraisal focused on ELS framework																								
	Formulate research objectives																								
Deciding Phase: Set goals & formulate a strategy	Select research methods																								
Experimenting Phase: Formulate a strategy & initiate implementation	Cyclone Idai Emergency Relief																								
Doing Phase: Continue implementation and monitor outcomes	Resource Flow Analysis																								
	Demonstration Farm																								
	Community Transect Walks																								
	Focus Group																								
	Market Analysis																								
	Cost Benefit Analysis																								
	Community Meetings																								
	Coordinating with local leaders																								
Evaluating Phase: monitor and evaluate outcomes	Develop pragmatic next steps with community																								
Reflecting Phase: Evaluate outcomes & reflect on principles	Compile the Results																								
	Develop the project proposal (write thesis)																								
	Literature Review																								

Source: Author's own

The two constants throughout this research process were an ongoing form of praxis that alternated between critical reflection on lived experiences and ongoing interrogation of theory. As such, although the research design provides a scaffolding and the project timeline provides a sequential guide, in reality, the research process unfolded through a dialogic approach that integrated theoretical insights and real world experiences. This is an important point of the research methodology and rather than being a limitation or impediment to the research process, this nonlinear, iterative and flexible approach opened the possibility to adapt and respond to critical and life-threatening community needs that came about from one of Southern Africa's worst natural disasters, Cyclone Idai. To describe this unfolding research process and methodology I will now reflect on the theory that informed each phase of research design and by track how the research methodology played out in reality.

4.4.2.Updating phase

Theory (Reflection)

The intention of the updating phase it is to reconsider and update the problem setting by reflecting on the lens (research paradigm), values and guiding principles that inform the project planning and research process. Reality is not stagnant. It is constantly being reconstructed and reconstituted through collective experiences, values and relationships (Mezirow 1981; Freire 1989; Brown 2004; Mertens 2007; Rogers et al. 2013; Romm 2015). The updating phase is an opportunity to pause and update individual and collective frames of reference as we cycle back to the framing phase where a new and refined vision is created (Pahl-Wostl et al. 2007; Biggs, Westley & Carpenter 2010; Rogers et al. 2013; Biggs et al. 2015b; Dentoni, Bitzer & Schouten 2018). As such, the updating phases serve as a bridge to past and future iterations of the research (re)design process. Ultimately, the goal of the updating phase is to suspend our preconceived notions and consider how the “problem space can be loosened so that a wider range of options for action emerges” (Rogers et al. 2013).

Practice (Action)

The formulation of the research design is rooted in the past experience and dynamic interactions I had over the previous eight years of working with the community of Nguinea, Mozambique through my community based non-profit organisation, Local Development Catalyst Network (LDCN). The first step in this research design was thus to update my personal frame of reference by reviewing the past activities of LDCN as an organisation as well as the relationships I had developed with the community. The main method for doing this was to review past organisational reports, newsletters and annual reports as well as my personal journal. From this reflection, I reviewed the guiding principles and mission of LDCN, and selected the transformative research paradigm and CBPAR approach as a lens and starting point for developing the research design.

4.4.3. Framing phase

Theory (Reflection)

The goal of the framing phase is to further develop an understanding of the problem setting and to lay the foundation needed to develop a collaborative vision for moving forward (Schön 1993; Pahl-Wostl et al. 2007; Daviter 2017; Cleaver & Whaley 2018; Dentoni, Bitzer & Schouten 2018). As Schön (1993:138) states, “the essential difficulties in social policy have more to do with problem setting than with problem solving, more to do with the way in which we frame the purposes to be achieved than with the selection of optimal means for achieving them.” By developing a more nuanced understanding of how a problem is set in reality, the opportunity to reframe or to see a problem in new and potentially useful ways may emerge (Schön 1993; Pahl-Wostl et al. 2007; Rogers et al. 2013; Dentoni, Bitzer & Schouten 2018). Problems shift from descriptive truisms to mediated dilemmas that can be reconstructed and reconfigured through collective sense making (Dentoni, Bitzer & Schouten 2018). As such, the problem setting acts as a point of departure by setting the imaginative boundaries within which a given intervention will take place (Rogers et al. 2013; Biggs et al. 2015b). From these imaginative boundaries, the researcher can then set the physical boundaries (scale and scope) of the intervention.

Having defined the imaginative and physical limits, the researcher can consider the socio-ecological dynamics at play, paying particular attention on how and where power manifests itself (Nadasdy 2007; Muro & Jeffrey 2008; Brown 2014; Dyer et al. 2014; de Vente et al. 2016; Cleaver & Whaley 2018). This understanding extends not only to the formal structures, hierarchies and institutions, but also the equally important informal spaces, places and relationships embedded in the problem setting (Nadasdy 2007; Cleaver & Whaley 2018). Utilising a formalised CBPAR process based on best practices and prescribed methods in contexts characterised by high degrees of informality may be impractical and ineffective. This is particularly acute in developing world contexts where rules, regulations and livelihood strategies are often times enacted and enforced through a complex set of locally specific informal social structures and relationships. An essential part of the framing phase is thus to develop an awareness and sensitivity to the myriad of influences, symbols, perspectives and relationships that constitute and define local reality (Cleaver & Whaley 2018).

Having developed an understanding of the problem setting, the foundation for a collective visioning process and terms of engagement can then be established (Howarth & Monasterolo 2010; Rogers et al. 2013; Jasanoff 2017; Dentoni, Bitzer & Schouten 2018; van Breda & Swilling 2019). Essential to this process is to clarify intentions and expectations, to collectively define key concepts such as ‘community’ and ‘participation’ and to negotiate transparent and mutually agreed upon terms of engagement (Butler et al. 2016; Trimble & Plummer 2019). Ideally, this should be done by seeking feedback and buy in from a diversity of stakeholders and/or community members (Howarth & Monasterolo 2010; Berkes 2018).

Practice (Action)

Building off the guiding principles of the CBPAR and my personal reflections, I framed the problem setting through two main activities. First, I set the boundaries of the research process by defining the scale and scope of research activities. This process was based on analysing what was economically viable based on LDCN's resources, programmatically feasible based on community capacities and, finally, operationally possible based on my skills as a researcher and community development facilitator. The intersection of these three considerations led to the decision to work at the immediate neighbourhood and community level surrounding my home and demonstration farm in Nguineaia, Mozambique, and to build off pre-existing projects and relationships.

The second activity was to collect local sustainable development statistics at a district level (Nhamatanda District) to help justify and inform the scope of research activities. The goal was to balance my more subjective and qualitative personal reflections and lived experience with a more quantitative and objective problem defining analysis. Accordingly, I researched and collected key information in relation to key WEF nexus and livelihood statistics, the ecological and environmental setting, the socio-economic conditions and the socio-political and cultural history of the region. Building off this information I crafted a motivation narrative (see section 1.2), research problem statement (see section 1.3), and problem setting narrative (see section 5.2).

Due to the high degree of informality and my longstanding relationship with the community, my engagement with the community during these initial phases was more informal in nature. By deciding to work at a more immediate neighbourhood level surrounding my home and demonstration farm, I was able to build off the mutual understanding and more informal personal relationships developed over the previous ten years. Initiating a more formal community engagement process at such an early stage of the research process would prematurely shift and alter expectations of community members. In order to meet and ensure the ethical standards of this research process, however, a community meeting was scheduled for later in the research process (March 2019) to establish a more formal vision and terms of engagement.

4.4.4. Exploring phase*Theory (Reflection)*

During the exploring phase, stakeholders, community members and researchers collectively explore opportunities to enhance local wellbeing through a community assessment process. The community assessment process is aimed at identifying important skills, capacities and livelihoods assets that can be catalysed to stimulate meaningful development in locally relevant ways (Osbaahr et al. 2008; Biggs et al. 2015a; Lazarus et al. 2015; Massoud et al. 2016; Lundy & Adebayo 2016;). The goal is to encourage community feedback through an inclusive and participatory process while identifying a breadth of opportunities and a range of development

pathways. Each of these pathways should ideally be oriented towards goals and objectives identified by community members.

In order to facilitate this assessment, a nuanced understanding of stakeholders and local power dynamics is needed (Nadasdy 2007; Muro & Jeffrey 2008; Brown 2014; Dyer et al. 2014; de Vente et al. 2016; Cleaver & Whaley 2018; Wallerstein et al. 2020). Power is enacted and deployed through visible and invisible power structures and social hierarchies in ways that can constrain the agency of individuals and groups in a particular community (Cleaver & Whaley 2018). It is, therefore, essential to reflect and understand how and where power is exerted and for what purpose (Muro & Jeffrey 2008). Although participatory approaches can promote inclusiveness and power sharing arrangements, they are not always sufficient for dealing with the more systemic and insidious nature of inequality (Brown 2014; Wallerstein et al. 2020). Participatory approaches can bring unequal players to an uneven table thereby allowing local elites to co-opt a process and use it as a space for political suasion and manipulation (Minkler 2000; Irvin & Stansbury 2004). A nuanced understanding of power is thus essential to calibrate and establish the degree and quality of collaboration that is possible. Ultimately the goal of the exploring phase is to foster key feedback loops, to identify important community assets, to surface potential friction points and challenges and to develop a range of development pathways that can be deliberated upon in the deciding phase to follow (Muro & Jeffrey 2008; Wyborn 2015; Berkes 2018).

Practice (Action)

The goal of the exploring phase was to develop a range of options for the ‘who’, ‘what’, ‘where’ and ‘how’ of the research process. I started with a stakeholder analysis in which I worked with LDCN’s local project manager, Lourenço Cozinha, to identify potential participants and stakeholders to participate in the research process. This initial stakeholder analysis took place during my first site visit in November of 2018 and to further enhance our analysis, we corroborated our findings with the local appointed community leader, or “secretario do bairro” (neighbourhood secretary), Armando Rosario.

Having completed this initial stakeholder analysis, I then implemented a rapid rural appraisal with Lourenço and Armando. The rapid rural appraisal also took place in November 2018 and consisted of a community transect walk in which we traversed the community by following a local seasonal river. We started the walk around 6:00 AM and stopped to informally interview ten local community members to gain insight into how they accessed water, food and energy resources. We also relied on our collective experience and direct observation of community members to enhance our analysis. This analysis helped to illuminate the different formal and informal strategies, relationships and assets local people depend on to secure access to water, energy and food. In order to organise and make sense of this initial data collection, I utilised the environmental livelihood security (ELS) matrix developed by Biggs et al. (2015) (see section 3.3). This initial and rapid data collection helped to triangulate past observations and more subjective analysis. It also helped to inform our

initial set of research objectives (see section 1.4) and inform potential methods for future data collection (see section 4.4.5)

4.4.5. Deciding phase

Theory (Reflection)

Building on the community assessment process, multiple implementation strategies that build on local strengths and assets may emerge. In order to chart a pathway forward, the goal of the deciding phase is to proactively choose a strategy, or set of methods, to pursue (Rogers et al. 2013). The deciding phase, therefore, requires weighing the potential synergies and tradeoffs of different trajectories and methods as well as weighing the capacities and capabilities for implementation (Howarth & Monasterolo 2017; Kurian 2017; Ghodslavi, Krishnamurthy & de Vries 2019). This inherently entails deliberation and negotiation in order to develop “‘serviceable truths’ – that is, robust statements about the condition of the world, with enough buy-in from both science and society to serve as a basis for collective decisions” (Jasanoff 2017:25). An essential element of developing these serviceable truths is recognising that reality does not take place on neutral ground but rather in a politicised space laden with power differences (Jahn 2008; Daviter 2017; Dentoni, Bitzer & Schouten 2018; Ghodslavi et al. 2019).

This observation is particularly relevant to disadvantaged communities in Africa where it is assumed that due to the challenges of poverty, it is in a community’s best interest to work together with development projects (Cleaver 1999; du Pisani & Sandham 2006; Audouin & de Wet 2012; van Breda & Swilling 2019). However, community members may have a range of values, motivations and understandings of what development is and why they are engaging with a particular development process (Audouin & de Wet 2012; Brown 2014; de Vente et al. 2016). Furthermore, as du Pisani and Sandham (2006) point out, oftentimes more disadvantaged communities are not in a position to confront or oppose development projects as they can fulfil meaningful short-term needs. Accordingly, to ensure these short-term needs and benefits are met, community members may acquiesce and give lip service to a development process, while in their everyday lives they continue practices that may silently subvert or sabotage big picture goals (Irvin & Stansbury 2004; Cleaver & Whaley 2018). Oftentimes such conflicting motivations only surface in later stages and thus negotiation turns into retroactive mediation process rather than an empowering community building process (Irvin & Stansbury 2004; Dyer et al. 2014; de Vente et al. 2016). As such, a key step in the deciding phase is to identify these potentially conflicting motivations early on and build in meaningful incentives and mechanisms to earn community buy in and support.

Practice (Action)

The deciding phase was about developing the theoretical strategy and context specific set of methods to bring the research goals and objectives to life in meaningful and locally relevant ways. The specific methods were

selected and designed by LDCN's local project manager and me and were based on community input collected during the rapid rural appraisal and stakeholder analysis (see Table 4: Research methods and their intended purpose). Collectively, the methods were part of a mixed methods approach aimed at providing a balance of qualitative and quantitative data. In addition to the community input, key considerations in selecting these methods surrounded the incentives needed to sustain participation, the potential to foster learning and build local capacity and the relevance to developing a project proposal. All of the methods were designed to be implemented with and reflected upon with local community members. They were designed to address and develop insight into community needs, to foster critical community feedback and to collect important data needed to develop a project proposal. They were also oriented towards priming a longer-term transformation process, based on cooperative and collaborative mutual learning and, aimed at promoting a more equitable, inclusive and locally relevant form of sustainable development.

Table 4: Research methods and their intended purpose

Research objective	Method	Intended purpose of research method
Collaboratively quantify socio-ecological inputs and outputs of LDCN's demonstration farm	Resource flow analysis	<ul style="list-style-type: none"> Quantify the socio-ecological inputs and outputs of our local demonstration farm; Develop baseline data that can be used to simulate different expansion strategies and nexus development scenarios; Collect this data with community members to build local capacity and knowledge of the demonstration garden.
Pilot a community extension programme	Demonstration farm	<ul style="list-style-type: none"> Demonstrate locally relevant methods and technologies to enhance WEF nexus outcomes; Develop a space for formal and informal interactions, to share experiences and knowledge, and to cocreate solutions to local needs.
	Community transect walk with local leaders	<ul style="list-style-type: none"> Understand local perceptions and values around natural resources and their management; Identify livelihood assets and practices and their relationship to natural resources; Identify important conservation areas and potential intervention sites.
	Focus group	<ul style="list-style-type: none"> Collaboratively analyse data collected during research process; Brainstorm, develop and evaluate different expansion scenarios; Identify potential evaluation criteria or indicators to measure success.
	Market analysis	<ul style="list-style-type: none"> Understand the local market dynamics. Survey available agricultural produce and collect prices for a different quantities and units in regional markets; Assess different livelihood opportunities.
Develop an attractive and fundable project proposal	Cost-benefit analysis	<ul style="list-style-type: none"> Compare the input costs and outputs of different WEF nexus interventions on LDCN's demonstration farm; Develop a budget of potential future interventions and projects; Discuss community contributions and potential benefits associated with participation and implementation.
Explore the long-term socio-ecological conditions needed for a more sustainable and	Community meetings	<ul style="list-style-type: none"> Maintain open and transparent communication with the broader community and develop key terms of engagement; Receive broad feedback from community members surrounding different interventions and future pathways;

locally relevant from of ecosystem governance to emerge		<ul style="list-style-type: none"> • Create a space to share and disseminate information on the outcomes of different research methods
	Coordinating and working with local leaders	<ul style="list-style-type: none"> • Work with and seek out the input of local community leaders and community members. • Build the management capacity of local leaders through collective reflection and analysis of research outcomes; • Brainstorm, develop and evaluate different expansion scenarios; • Consider locally relevant evaluation criteria; • Pilot a local advisory board to test its efficacy and compatibility for facilitating local development interventions.

Source: Author's own

4.4.6. Experimenting phase

Theory (Reflection)

Having decided on a strategy, the experimenting phase is about nudging the system by taking the initial steps needed to implement the research design (Snowden & Boone 2007; Kurian 2017; van Breda & Swilling 2019). This piloting process is used to actively test and verify the implementation logic and feasibility of the research design strategy and its associated methods. Acting on a theoretical strategy adds a lived complexity and new set of dynamic challenges and opportunities. As such, a key consideration of the experimenting phase is to start where it makes pragmatic sense and to probe and verify the implementation strategy through small and 'safe to fail' activities (Rogers et al. 2013; Butler et al. 2016; Kurian 2017; van Breda & Swilling 2019).

In doing so, the goal of the experimenting phase is to gain a more nuanced understanding of the social dynamics of the problem setting (Butler et al. 2016; van Breda & Swilling 2019). This more reflexive approach strays from the traditional cause and effect logic of project planning and, instead, is rooted in the idea of emergence, where relative minor actions can cause reverberations, disturbances and changes in the system (Morin 2007; Cilliers 2008; Rogers et al. 2013). Accordingly, the goals of the experimenting phase are to develop the capacity for critical reflection and to foster the individual and collective feedback loops needed to recognise and capitalise on opportunities that result from this emergence. Depending on the outcomes of the experimenting phase, a project or process may need to return to and refine the implementation strategy prior to moving forward.

Practice (Action)

Having decided on the set of methods needed to enact the implementation strategy, the next step was to move from theory to practice in the experimentation phase. However, just as I was about to host our first community meeting and start the formal implementation of the research methods, one of the worst recorded natural disasters in Southern Africa, Cyclone Idai, devastated the region in March of 2019. This unanticipated catastrophic event completely shifted the problem setting in ways that were unforeseen during the previous more design oriented

phases. Rather than experimenting and testing our research methods and strategy, we had to respond and adapt to the critical and immediate needs brought on by this natural disaster. Rather than probing, sensing, and responding in safe to fail ways while experimenting and testing our implementation strategy, we were forced to move into immediate and direct action in order to respond to this critical and life threatening situation.

The district of Nhamatanda, and more specifically the community of Nguinea where the research was taking place (see section 5.2.1 for a map of the project location), was one of the epicentres of the humanitarian crisis connected to Cyclone Idai. The entire community was flooded by more than three metres of water which left a wake of destruction in which everyone in the community lost their homes and the majority of their possessions. The demonstration farm and my home were severely damaged. Major provincial highways and critical infrastructure were washed out from the flooding and as a rural part of the district located in the interior of the province, the community of Nguinea remained isolated with severely limited access to humanitarian relief efforts. Due to this critical situation, the focus areas of the research, improving access to water, energy, food and other livelihood assets, took on a whole new level of urgency and meaning.

For the immediate month following Cyclone Idai, LDCN was the only organisation actively providing relief and support to communities in this less accessible part of the Nhamatanda District. We distributed food, soap, seeds, water filters and water treatment tablets to approximately 10,000 people in addition to helping coordinate a cholera vaccination drive in the area. We were able to mobilise and act so quickly due to our extensive local network and understanding of the region as well as the relative lack of bureaucracy we faced as a grassroots community-based organisation.

Although I was able to eventually redesign and implement the original methods in the doing phase of the research process, the meaning, intention and practice of implementing these methods completely shifted. This experience highlighted the complex, dynamic and unpredictable nature of reality and the need to be adaptable and start where it makes pragmatic sense.

4.4.7. Doing phase

Theory (Reflection)

The doing phase is the roll out of activities and includes the tracking of progress towards expected outcomes (Rogers et al. 2013). The doing phase is about more than just implementing a specific strategy or set of methods, it is about remaining sufficiently open to learning and responding to the dynamic interactions of the broader system and any unexpected outcomes that may arise during implementation (Rogers et al. 2013; Biggs et al. 2015b; Kurian 2017; Berkes 2018). As such, the doing phase may include multiple cycles of action and reflection and furthermore must remain vigilant to any windows of opportunity that may open during the implementation process (Westley 2013; Butler et al. 2016; van Breda & Swilling 2019). Although doing

connotes action, it may also require a situational awareness that demands restraint, stepping back, avoiding quick judgements and nurturing outcomes over longer time scales or new and refined methods (Berkes 2009; Rogers et al. 2013). If implementation is hurried or rushed, this may lead to premature conclusions and contribute to unrealistic future expectations (Rogers et al. 2013; van Breda & Swilling 2019). Alternatively, if windows of opportunity arise or unexpected events lead to a shift in the problem setting, the doing phase may also require acting in the face of considerable uncertainty (Snowden & Boone 2007; Rogers et al. 2013). The ability to recognise what the problem setting and socio-ecological dynamics are suggesting and/or dictating is a critical skill during the doing phase.

Practice (Action)

In relation to the research design, the cyclone did not allow going back and progressively working through each of the phases to develop an implementation strategy. Instead we were constantly updating the problem setting and strategy by acting, sensing and responding where there was immediate need. As the initial crisis subsided by June of 2019, and the longer-term food crisis emerged from the widespread loss of livelihood assets, crops, and seed stores, we were able to go back and reflect, plan and engage with the community in a more formal way. Prior to the cyclone, I had not initiated a formal implementation of the proposed research methods and much of my planning and interactions with the community had been more informal in nature. However, after the cyclone, the need to formally engage and coordinate with the local community was paramount in order to ensure an efficient and equitable distribution of humanitarian relief. Stemming from this more formal engagement, I was able to reexplore the goals and objectives of the research and subsequently adjust the implementation strategy by experimenting and shifting our methods and practices based on the new context. Ultimately, we were able to implement each of the methods in our original implementation strategy, however the meaning, intention and practice of enacting them was significantly different than what we had originally imagined (see Table 5: Lived practice and practical application of methods).

Table 5 : Lived practice and practical application of methods

Design strategy/ Research method	Lived practice/Practical application of methods
Resource flow analysis	LDCN's demonstration farm was destroyed during the cyclone. The resource flows analysis was therefore more reflective of a rebuilding process and accordingly the data had a greater focus on the inputs rather than the outputs. The period for data collection was also significantly shortened due to the impacts of the cyclone.
Demonstration farm	The demonstration farm became a neighbourhood meeting space and key distribution centre in the aftermath of the cyclone. The left-over building and roofing materials from my home/centre were used to erect temporary housing structures for women and children who were left without homes in addition to tents we erected for community members as they rebuilt their homes. LDCN's borehole was the only location for access to clean water and became the primary water collection point for the surrounding area. The demonstration farm was also used as a cholera vaccination point. Finally, throughout the research process we were able to fully

	replant our demonstration farm. Part of the production from the garden was donated to a local school and part was sold in local markets.
Community transect walk with local leaders	<p>We engaged in multiple formal and informal community transect walks with village leaders and community members. Initially (the first 4-6 weeks after the cyclone), these walks were informal walks (and bicycle rides) used to identify where and how the cyclone impacted the area, to take stock of the destruction from the cyclone, to identify potential access paths for transport of humanitarian relief supplies and to more broadly evaluate how to support relief efforts. The walks included stopping and visiting community members (informal interviews) to provide emotional support and solidarity as well as to collect important data to inform relief efforts.</p> <p>Using the initial data from these transect walks we developed a supply chain to walk in food relief. These resupply walks served as larger community transect walks in which groups of up to 50 community members collectively carried over ten tons of food to isolated communities in the surrounding region in the weeks following the cyclone and before vehicles could enter into the region.</p> <p>Additionally, LDCN hosted and guided a number of international relief organisations during these walks to familiarise them with the region, spread awareness of the humanitarian crisis, introduce them to community leaders and to inform longer term relief efforts. After the immediate crisis subsided, we engaged in more formal community transect walks with community leaders in order to collect data and input needed to map out potential locations to support food production efforts, to drill boreholes and to support other community oriented livelihood projects.</p>
Focus group	Our focus group transformed into a women farmers group that LDCN supported with agriculture inputs to produce food to support their families and a school feeding scheme. The cyclone brought on a devastating food crisis due to the widespread loss of crops and the initiative to support these women stemmed from a neighbourhood meeting in which community members expressed a desire to replant their fields and to support and feed the local children during the food crisis. In addition to supporting the women with extension services and inputs to produce food, we also hosted monthly workshops and meetings to check in with the women and reflect on the process of working together.
Market analysis	<p>The market dynamics and availability of food was severely impacted by the cyclone. The market analysis took two separate phases. The first was in the immediate days and weeks after the cyclone (March – May 2019) in which the objective was to identify where food could be purchased locally to support immediate food distribution and relief efforts. We were able to identify a number of local shops and markets where we could purchase food rather than waiting for international food relief to arrive.</p> <p>The second phase (June – October 2019) was after the initial crisis subsided. The objective was to evaluate the origin of different agriculture products as well as the unit cost. We did the second phase of the market analysis together with the women from the focus group by visiting local markets to sell our surplus vegetable production and to collect the data together. In total we made four market day visits with the group of local women. As part of these visits we also discussed the results and of particular importance to these discussions was the impact of the cyclone on prices and availability of staple food items and the seasonality of different crops.</p>
Cost-benefit analysis	The cost benefit analysis was conducted through a transparent budget review of LDCN relief efforts with local leaders and direct participants of programmes. This was specifically done with school leaders as part of LDCNs efforts to rebuild three local schools, and with the women from the focus group regarding the inputs provided to them as part of their participation.
Community meetings	Formal community meetings took a much more prominent role than previously imagined in the preliminary research design. In an effort to distribute food transparently and fairly in the weeks following the cyclone, food was always distributed in public spaces with the entire community present. To facilitate this process, we worked at smaller community and neighbourhood levels

	(maximum 200 families) and directly with local leaders. These distributions were also an opportunity to share important information, build awareness around public health issues such as cholera and malaria, and collectively reflect on next steps. Once food relief distributions ended, these community meetings continued to coordinate other activities such as rebuilding the local school and initiating the school feeding scheme.
Coordinating and working with local leaders	Coordinating all of LDCN's relief efforts in the weeks and months after the cyclone required extensive coordination with local leaders. This included working with the directors and school committees of three local schools in order to rebuild the three schools. It also included coordinating with the local neighbourhood secretaries (or " <i>secretarios dos bairros</i> "), or local government representatives, to coordinate distributions. Finally, it required working with international aid organisations and other outside stakeholders involved in relief efforts. In addition to our coordination efforts, we also used the opportunity to elicit feedback from community leaders and explore different ways to support to offer support.

Source: Author's Own

4.4.8. Evaluating phase

Theory (reflection)

The evaluating phase is about reviewing the outcomes and effects of the activities and implementation strategy. Whereas outcomes refer more to the qualitative, process oriented and social impacts of a given intervention, effects refer to the more quantitative socio-ecological impacts (Plummer et al. 2017a). As such, the evaluating phase is focused on reviewing both the process and results of a given intervention (Fabricius & Currie 2015; Kurian 2017; Trimble & Plummer 2019). This requires returning to and reviewing the vision, objectives, strategy, activities and outcomes to determine if, where and how the project was successful. This includes considering any problematic tensions or tradeoffs as well as potential synergies and future opportunities. Of importance is the fact that the evaluation should include and engage stakeholders to further strengthen feedback loops and social learning (Fabricius & Currie 2015; Chapman et al. 2016; Butler et al. 2016; Trimble & Plummer 2019).

Practice (action)

The evaluating phase was about collectively reviewing and tracking what transpired during the research process including the events before and after the cyclone. This was accomplished through community meetings as well as in smaller more intimate settings with women from the focus group, local leaders and LDCN's local staff. The results of this evaluation and reflection included identifying the more incremental and instrumental successes that took place during the research process. It also included deliberating with the community on potential future pathways and on practical application of the methods during the research process. In exploring some of these future pathways, we were able to identify some tangible and pragmatic next steps and opportunities to extend and amplify results from the research process (see Chapter 6 for more detail).

4.4.9. Reflecting phase

Theory (reflection)

The reflection phase is about moving from a review of the outcomes and effects of the project to a broader reflection on the process as a whole. This allows for critical reflection on the sense making and learning that took place (Berkes 2009; Rogers et al. 2013; Berkes 2018). It also requires challenging and reflecting on the underlying principles and assumptions that consciously and unconsciously guided the process (Freire 1989; Rogers et al. 2013; Cleaver & Whaley 2018; van Breda & Swilling 2019). The key outcome of the reflection phase is to develop, reflect and refine a set of guiding principles that emerged from the process (van Breda & Swilling 2019). These guiding principles can serve as a working theory of change rooted in the lived complexity of developing, experimenting, doing, and evaluating a vision and development approach as part of a CBPAR process.

Practice (action)

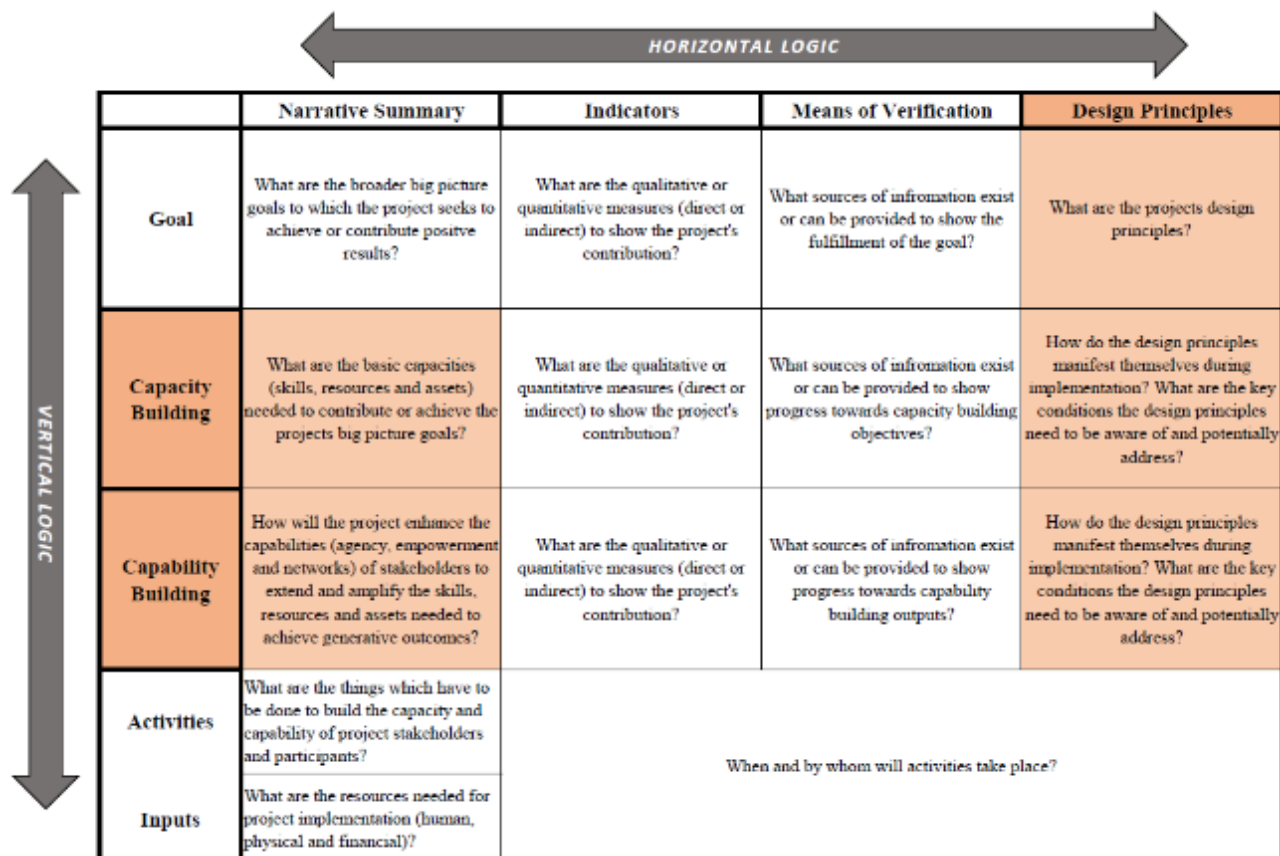
Although critical reflection was built into each phase of research design, the reflecting phase is an opportunity to step back, make sense of and integrate the diversity of experiences and knowledge that was coproduced through the research process. In addition to the shorter-term objectives, I engaged in a deeper more holistic reflection of the research methodology and approach as well as the guiding principles that informed the research process. This was done at a collective community level during a final community meeting held in October 2019. I also hosted my last in person meeting with both the local leaders and the women from focus group meeting in October 2019. LDCN's local project manager continued to follow up, give continuity and provide oversight to the projects through the remainder of 2020. I officially closed the data collection process with a final in person meeting with LDCN's project manager in Maputo, Mozambique in January 2020.

The goal of this final reflection process was to track and review the depth and breadth of data collected during the research process in order to identify the enabling conditions, opportunities, challenges and limitations to fostering sustainable development in Nguineia, Mozambique post Cyclone Idai. The key output of this more holistic reflection was to develop, refine and update a set of context specific and locally relevant guiding principles to help frame and guide a project proposal planning process. In combining the shorter term and pragmatic evaluation oriented towards tangible next steps and the long term reflection on the underlying principles and socio-ecological conditions needed to foster sustainable development, the reflection stage of the research process served as the transition point to developing a project proposal. The results of the both the evaluation and reflection phases will be presented more thoroughly in Chapters 5, 6 and 7 in the form of a five-year project proposal and LFM.

4.5. Final project proposal format – an adapted LFM

Each of eight these phases of the research design and project planning design flower is representative of the each of the eight phases of the LFA. To provide direction and operational insight, they also build on key theoretical insights from CBPAR and TDR as well as the lived practice of implementing community development interventions in rural Mozambique. The final remaining question, however, is how to translate the results from this research process into a meaningful project proposal. In this final section of the research methodology, I will present a modified version of the LFM that is adapted to present the particular findings and reflections of this research process.

More specifically, I suggest two structural changes to the LFM, one to the vertical logical and the other to the horizontal logic. The first structural change integrates Sen's (1990) capability approach into the vertical logic of the LFM by redefining the objectives row and the outcomes row to the capacity building row and the capability building row. To foster transformational change requires both the capacity, or the skills, resources and knowledge, and the capability, or the agency, freedom and relationships, for sustainable development. Redefining the vertical logic in this way forces a planner to consider how the objectives and outputs of a given intervention contribute to both the capacity and capability to achieve generative outcomes. The second change is to redefine the assumptions column as the design principles column. By shifting the assumptions column towards design principles, it offers a project planner a set of guiding logics to help deal with problematic assumptions when they do arise. In doing so, the project principles can help move the LFM beyond its more rigid and deterministic tendencies and absorb the inherent complexity that comes with implementing sustainable development in practice. The remainder of this section will explain in greater detail how I integrated these changes in my own LFM (see Table 6: Adapted LFM).

Table 6: Adapted LFM


The diagram shows a table with five columns and four rows. A horizontal double-headed arrow at the top is labeled 'HORIZONTAL LOGIC'. A vertical double-headed arrow on the left is labeled 'VERTICAL LOGIC'.

	Narrative Summary	Indicators	Means of Verification	Design Principles
Goal	What are the broader big picture goals to which the project seeks to achieve or contribute positive results?	What are the qualitative or quantitative measures (direct or indirect) to show the project's contribution?	What sources of information exist or can be provided to show the fulfillment of the goal?	What are the projects design principles?
Capacity Building	What are the basic capacities (skills, resources and assets) needed to contribute or achieve the projects big picture goals?	What are the qualitative or quantitative measures (direct or indirect) to show the project's contribution?	What sources of information exist or can be provided to show progress towards capacity building objectives?	How do the design principles manifest themselves during implementation? What are the key conditions the design principles need to be aware of and potentially address?
Capability Building	How will the project enhance the capabilities (agency, empowerment and networks) of stakeholders to extend and amplify the skills, resources and assets needed to achieve generative outcomes?	What are the qualitative or quantitative measures (direct or indirect) to show the project's contribution?	What sources of information exist or can be provided to show progress towards capability building outputs?	How do the design principles manifest themselves during implementation? What are the key conditions the design principles need to be aware of and potentially address?
Activities	What are the things which have to be done to build the capacity and capability of project stakeholders and participants?	When and by whom will activities take place?		
Inputs	What are the resources needed for project implementation (human, physical and financial)?			

Source: Adapted from Bakewell & Garbutt (2005)

4.6.1. Vertical logic – from objectives and outputs to capacities and capabilities

First, I adapted the vertical logic of the LFM from an objectives/outcomes orientation towards a capacity/capability orientation. This shift builds off Amartya Sen's (1990) ground breaking capability approach to economic development in which he argues that enhancing the freedom to achieve wellbeing through meaningful choice should ultimately be the goal of development. This shift towards a capacity/ capability orientation represents an important shift from the traditional view of economic or material prosperity as the end goal of development. Instead, economic prosperity becomes "no more than one of the means to enriching the lives of people" (Sen 1990:42). Building off this assertion, the goal of development is not a material ends but rather the enhancing of the diversity of opportunities, or the means, to act on one's capabilities to generate valuable outcomes through meaningful and intentional choice (Sen 1990).

When applied to a project planning process, it therefore becomes essential to distinguish between capacity and capability. On the one hand, capacity refers to the latent and perceived assets and skills needed to secure one's livelihood in meaningful and relevant ways (Sen 1990; Harley 2005; Williams 2010). The capacity for change, however, does not mean that that change will actually take place. It simply acknowledges the presence and potentiality of the skills, knowledge and resources needed to transcend a or resolve a particular problem (Freire

1989). On the other hand, capability refers to the actual practice and choice to use of that knowledge to achieve a particular goal (Sen 1990; Harley 2005; Williams 2010; Wyborn 2015). Capability, therefore, connotes the ability, freedom and the choice to deploy one's skills and assets.

This distinction is important as capacity, or the theoretical existence of skills, resources and other more instrumental tools for development is a necessary but not a sufficient condition to achieve generative outcomes and human wellbeing (Sen 1990; Harley 2005; Williams 2010). A person needs the skills and assets for development, as well as the freedom, agency and ability to use those capacities for generative outcomes (Sen 1990). Accordingly, capacity building and capability building require different resources, processes and levels of support during implementation (Harley 2005; Williams 2010).

This shift integrates a more layered approach that focuses on the means rather than the ends (Sen 1990). As such, the capacity building stage is focused on developing the awareness, skills and knowledge to address a particular problem. The capability building stage then extends and amplifies the awareness, skills and knowledge to foster a greater capability for participants to achieve positive outputs for themselves (Hummelbrunner 2010; Jacobs, Barnett & Ponsford 2010; Williams 2010; Golini, Landoni & Kalchschmidt 2017). Moving from capacity to capability, therefore, reflects an important step from the theoretical ability to use knowledge and skills in the capacity building stages, to the actual agency, practice and application of those skills and knowledge, in different conditions and for different purposes, during the capability stage (Williams 2010; Rogers et al. 2013; Wyborn 2015).

4.6.2. Horizontal logic – from assumptions to design principles

The second adaptation to the LFM is to redefine the assumptions column of the matrix as a design principles column. As currently defined, the assumptions column is used to identify external factors, events or conditions that are outside the project's control, and that may inhibit, prevent or hinder progress towards the goals and objectives (Coleman 1987; Gasper 2000; Bakewell & Garbutt 2005; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). Identifying the key assumptions highlights the minimum conditions necessary for successful implementation of a project (Coleman 1987; Gasper 2000; Bakewell & Garbutt 2005; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). It also contributes to developing a risk management strategy to help mitigate the potential impact of outside influences if and when they manifest themselves (Coleman 1987; Gasper 2000; Bakewell & Garbutt 2005; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). This more predictive manner of identifying assumptions and mitigating risks promotes a static design process in spite of uncertainty rather than a design process that absorbs and embraces uncertainty and the diversity of opportunities and challenges that come with it.

In the current LFA planning process, if a particular assumption or risk manifests itself, it is accepted in a more fatalistic manner and used as a justification for why project goals may not be achieved (Bakewell & Garbutt 2005; Harley 2005; Jacobs, Barnett & Ponsford 2010; Golini, Landoni & Kalchschmidt 2017). Although this provides a convenient scapegoat for failure, it misses an opportunity to develop a more resilient and adaptive approach to project planning that can catalyse and utilise uncertainty for generative outcomes (Rogers et al. 2013; Berkes 2018). It also misses an opportunity for critical reflection on the problem setting thereby stymying important learning.

If the assumptions are framed as design principles, however, externalities can be seen as limiting situations that can be transcended and transformed (Freire 1989; Rogers et al. 2013; Biggs et al. 2015b; Howarth & Monasterolo 2017; van Breda & Swilling 2019). The principles represent an anticipatory awareness of uncertainty and thus offer a starting point for reframing, refining and redeploying activities in emergent, generative and pragmatic ways when externalities manifest themselves in unintended or unexpected ways (Rogers et al. 2013; Biggs et al. 2015b; Howarth & Monasterolo 2017; van Breda & Swilling 2019). This focus on integrating design principles and guiding logics builds off van Breda and Swilling's (2018) work on an emergent transdisciplinary research approach. A key observation of van Breda and Swilling (2019) is that the design principles are not fixed or predetermined but rather unfold from and within the problem setting in which they are being developed. Due to this more fluid and emergent nature, there are no universal guiding principles applicable to all contexts. Instead, the guiding principles of a given project "should be seen as cognitive facilitators of imaginative and iterative decision-making processes" (van Breda & Swilling 2019:829). In order to deploy these "cognitive facilitators of imaginative and iterative decision making processes" an ongoing praxis of critical reflection and action, enhanced through multiple feedback loops, is needed.

In addition to this theoretical grounding for integrating design principles into the LFA, this reconceptualisation of assumptions as principles emerged directly from the need and lived reality of dealing with the devastating impact of Cyclone Idai during the research process. On the one hand, the cyclone could have provided a very easy justification as to why the research activities and methods were no longer viable. On the other hand, by building off the research principles, I was able to redeploy the research methods and activities in new and imaginative ways that simultaneously addressed critical needs while also providing invaluable insights into the project planning process.

For example, the original intention behind our focus group was to collaboratively analyse data collected during the research process and subsequently brainstorm, develop and evaluate different expansion scenarios. However, in reality, the focus group became a women's self help agriculture group focused on producing food to address the food crisis that followed Cyclone Idai. Although we still did collaboratively collect and analyse data as part of the women's agriculture group, the focus and the intention became much more practical and concentrated on addressing critical food security. This same shift can be seen in the lived reality and practical

implementation of most of the other methods as well. Our work with community leaders was focused on coordinating food relief efforts and rebuilding critical infrastructure. Our cost benefit analysis expanded beyond the demonstration farm and included implementing transparent budget reviews related to rebuilding three local schools. Finally, our initial market analysis and community transect walks were focused on locating and purchasing food for immediate food relief and finding the most effective means to transport food into the target region.

Ultimately, by reflecting on and refining the guiding principles through the research process and subsequently applying them to the project planning process, my intention was to create a theoretical and practical bridge to connect the research findings with a flexible and adaptable project proposal. As such, the principles provided a golden thread from the research findings to the project proposal, indicating a level of theoretical and practical coherence between the different stages, phases and iterations of the research design framework. Finally, the design principles also offered a certain resilience and adaptive capacity to deal with the fluid and complex nature of working in complex socio-ecological systems by allowing methods to be redeployed and used in creative and imaginative ways while still adhering the broader logic and approach.

4.7. Conclusion

Although being confronted with a natural disaster and humanitarian crisis in the midst of a research process is an extreme case of the uncertainty that comes with implementing a CBPAR process, it also reinforces the need for a flexible and adaptable approach to project planning. One of the key strengths of the research design was that it emerged and unfolded through the research process. The transformative research paradigm (section 4.2.1) provided a useful starting point for developing the broad values of the research process. It also helped to identify CBPAR (section 4.2.2) as the more specific research strategy and TDR (section 4.2.3) as a complementary approach to help overcome problematic tensions related to inequality, informality and limited stakeholder capacity. To give structure to this more theoretical foundation, I then utilised the LFA and LFM as a flexible prototype to develop a unique research design and project planning design flower (section 4.3). At the heart of this research design is an iterative eight phase research process that integrated an action oriented research approach with critical reflection and community engagement.

Using this research design as a guide, the research methodology (section 4.4) tracked how the research process unfolded in reality through a dialogic approach that alternated between critical reflection on theory and lived practice of implementation. A key outcome of this process was recognising the dynamic and complex nature of reality and the pragmatic need to adapt methods and activities to meet the needs of the community and better reflect the problem setting. This required continually shifting the implementation strategy by updating and reframing the methods during their application. In doing so, the research design reflected some of the characteristics of a TDR process by absorbing complexity and allowing for emergent outcomes and processes to surface and guide the CBPAR process.

Finally, to extend and translate the research design and methodology into a meaningful project proposal format, I modified the LFM to better reflect the process and results of the research design (section 4.5). This involved two key structural changes to the LFM including one to the vertical logic and one to the horizontal logic. Having established the lens, structure, process and presentation format of the research process, Chapters 5 to 7 will present and discuss the complete five year WEF nexus and sustainable livelihoods project proposal.

5. Chapter 5 – Problem setting & research results

5.1. Introduction

Chapters 5 to 7 will present the complete project proposal and although they are written with the intention to be a stand-alone project proposal, they do form part of a larger MPhil thesis. As such, some of the sections may seem somewhat repetitive of earlier sections of the thesis, found in Chapters 1 to 4. Furthermore, certain sections of Chapters 5 to 7 will also include a greater level of detail than would normally be expected in a typical project proposal. This is due to the need to more explicitly highlight and surface key insights and connections from previous sections of the thesis and to provide a golden thread that connects the literature review and the research methodology with the project proposal.

Chapter 5 will focus on presenting the problem setting (section 5.2), LDCNs organisational background and achievements (section 5.3) and the results of the research (section 5.3). Chapter 5 represents the key information needed to situate and ground the project proposal in reality. It should be read as the first part of the project proposal. Chapter 6 will provide an overview of the project proposal in the form of an executive summary (section 6.1) and logical framework matrix (section 6.2). Building on this broad overview of the project proposal, the remainder of Chapter 6 will focus on project objectives and outputs (section 6.3), the project activities timeline (section 6.4) and a detailed description of the key activities of the project (section 6.5). Finally, Chapter 7 will focus on the unique monitoring and evaluation framework developed for the project proposal by describing the indicators (section 7.1), the objective means of verification (section 7.2) and the project design principles. Collectively, these three chapters provide a robust and evidence based project proposal that is uniquely equipped to address local needs in Ndeja, Mozambique, through a locally relevant, ecologically sustainable and economically viable community development model.

5.2. Problem Setting

In March 2019, Cyclone Idai ravaged central Mozambique and the ensuing flooding resulted in an environmental disaster and human tragedy of devastating proportions. Although there was a considerable and immediate international response in the weeks and months that followed the cyclone, this support dwindled as the priorities and attention of the development industry shifted back to business as usual and an eye to preparing for the next natural/human disaster. Although this international support was absolutely essential for the short term safety, security and survival of millions of people in the region, the disproportionate focus on the immediate impacts of the cyclone has continued to disguise the need for greater attention on the slower, more insidious and longer term socio-ecological vulnerabilities of the region. These vulnerabilities had not only plagued the region long before the cyclone but also deepened the devastating impacts of the cyclone and continue to contribute to the persistence of multidimensional poverty.

This reflection may be seen by some as an indictment of aid and the broader development system, however, it can also be seen as an opportunity to reimagine the relative roles and responsibilities different actors have in fostering change, as well as the relative scale and scope of where and how sustainable development can emerge. As we approach the two-year anniversary of Cyclone Idai, a number of opportunities from the short-term disaster response have surfaced. They offer the potential to reframe this tragedy as an inflection point for longer term transformational change. In order to capitalise on these opportunities though, a pragmatic project focused on achieving a balance between meaningful short term interventions that address local needs, and a long term sustainable development vision with dedicated resources, committed leadership and community buy in is needed. Whereas larger development organisations are better positioned to mobilise resources, provide technical skills and foster vertical linkages and political support, community based organisations are better positioned to engage community stakeholders, foster community buy in, find innovative strategies, lead local development processes and hold the space needed for transformational change to take place in generative and equitable ways. In order to foster this type of fertile ground for sustainable development to emerge from the devastating impacts of Cyclone Idai, or for that matter any major disaster, a bridge needs to be built between large, top down, results driven organisations focused on tangible short term change, and, bottom up, process oriented, community based organisations focused on longer term transformation.

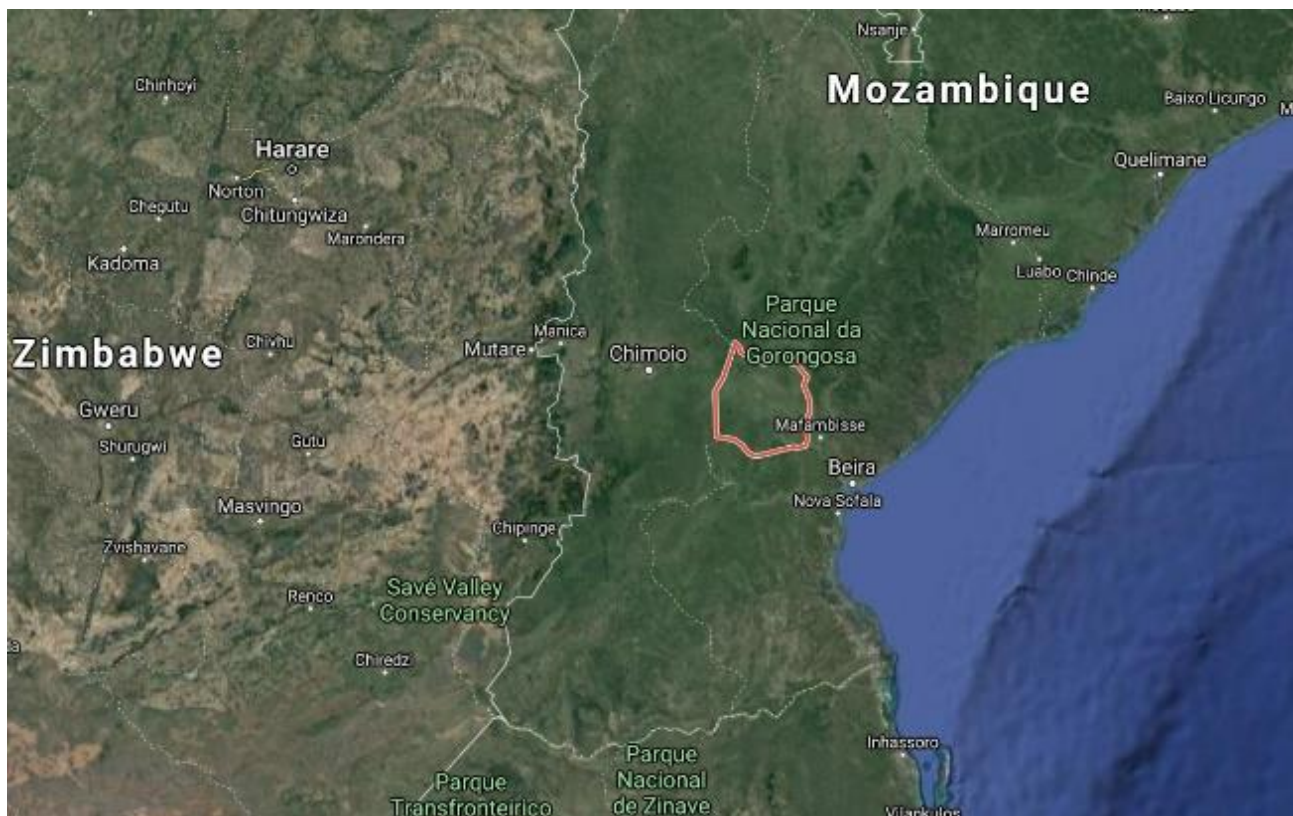
The following project proposal offers one potential bridge and is the culmination of Local Development Catalyst Network's (LDCN) ten years of living and working in the district of Nhamatanda, Sofala Province, Mozambique. It builds off the deep personal relationships, social connections, and nuanced understanding of the community that the organisation and its staff have developed over that time. It also stems directly from a Masters research thesis at Stellenbosch University, South Africa. The direct research took place from March to December 2019 with a follow up period to disseminate results in 2020. The research utilised a community based participatory action research process focused on surfacing the opportunities, challenges, insights and limitations for fostering sustainable access to water, energy and food by catalysing local livelihoods.

In addition to this more community oriented and research driven approach, the project proposal is also a reflection of the need to implement tangible, results driven interventions that provide data and accountability for development efforts. As such, the project is presented in a Logical Framework Matrix (LFM) and includes key indicators and benchmarks to track, monitor and evaluate progress over its five year duration. Finally, to demonstrate and provide the long term support and commitment needed to ultimately reach our big picture goals of fostering flourishing futures and sustainable ecosystem governance, the five year project proposal is embedded in a larger and longer term regional sustainable development plan and organisational theory of change.

5.2.1. Target Location

The district of Nhamatanda, Province of Sofala, Mozambique, is located about 100 km west of the port city of Beira on the EN6 or National Highway 6 (see Figure 6). It is a rural district that is approximately 4,000 km² and has a population of 279,081 people of whom approximately 47 percent are less than 15 years old (INE 2017). The district makes up part of the Beira Development Corridor, which is centred along the EN6 highway where a number of towns have been established. These towns serve as transportation hubs and provide access to markets and goods for the population. The largest, and administratively most important, is the town of Nhamatanda which serves as a municipality and the central location of government offices for the broader district. The district is then further subdivided into two administrative posts (Tica and Nhamatanda) and 11 localities (INE 2017).

Figure 6: Nhamatanda District, Sofala Province, Mozambique (outlined in red)

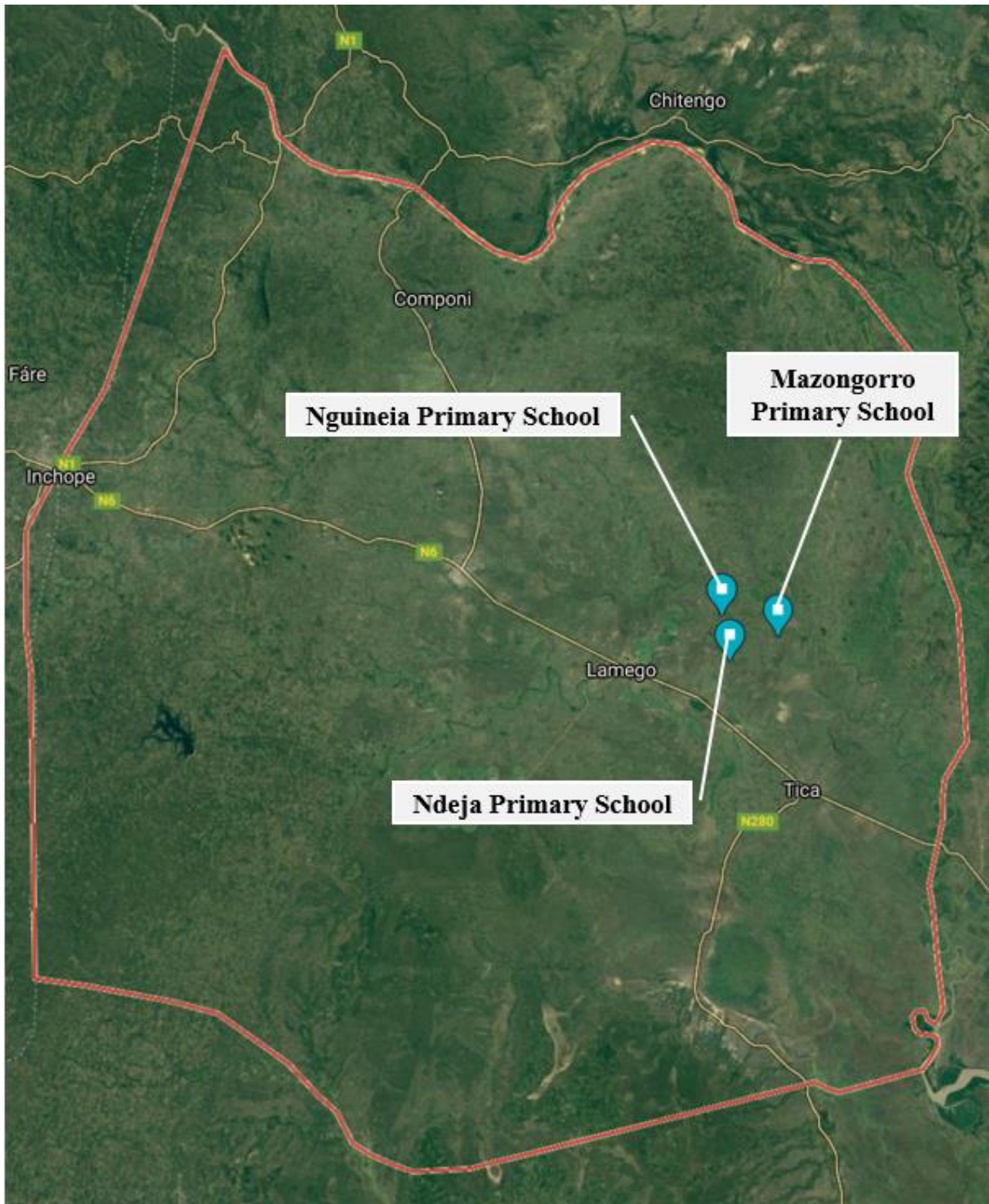


Source: Google Maps (2020)

The village of Ndeja, where the proposed project will take place, is located in the district of Nhamatanda, administrative post of Tica, locality of Lamego (see Figure 7: Proposed project locations). The locality of Lamego is located along the EN6 road and is further broken down into smaller villages and neighbourhoods. The village of Ndeja is made up of various neighbourhoods (“barrios”) and is located approximately 10 km north of the EN6 into the interior of the district. The community of Ndeja comprises approximately 1924 families or 13,468 people of whom approximately 7,946, or 59 percent, are under the age of 18 (Alliance2015,

2019). There is one complete primary school in the Ndeja community (Escola Primaria Completa de Ndeja), with two smaller satellite schools located in the neighbourhoods of Mazongorro and Nguineia.

Figure 7: Proposed project locations (Ndeja, Nguineia & Mazongorro)



Source: Google Maps (2020)

5.2.2. Project Beneficiaries

Direct Beneficiaries: 13,500 people

The project is specifically aimed at supporting the broader community of Ndeja. Our target group is specifically focused on the school catchment zone for the Ndeja primary school, including its two satellite schools in Nguinea and Mazongorro. The school of Ndeja has approximately 800 children (grade 1-7), the satellite school in Mazongorro has approximately 500 children (grade 1- 5) and the satellite school in Nguinea has approximately 350 children (grades 1-3). LDCN's proposed vocational training and community extension programmes are aimed at directly training and providing outreach services for approximately 500 families (approximately 3500 people) or 25 percent of the total population. The goal of our manual borehole drilling programme is to provide clean water for at least 75 percent of the population, or about 10,000 people.

Table 7: Direct project beneficiaries by neighbourhood

Neighbourhood	Number of Families	Number of people (estimated)
Ndeja (bairro 1)	224	1568
Massarecuenda	90	630
Nguinea	239	1673
Belita	143	1001
Nhasimbingue	205	1435
Ndeja (bairro 6)	40	280
Njove	94	658
Mazongorro	157	1099
Mangomo 1	144	1008
Mangomo 2	230	1610
Josina Machel	150	1050
Bairro 25 de Junho	208	1456
TOTAL	1924	13,468

Source: Alliance2015 (2019)

Indirect beneficiaries: 250,000+ (Nhamatanda District)

The indirect beneficiaries will be all residents of the Nhamatanda District. The total population of the district is approximately 280,000 (INE 2017) and the goal of the project is to contribute to a positive shift and broader upliftment at a district level.

5.2.3. Socio – political historical context

The current political climate in Mozambique has its roots in the confrontations that emerged from its struggle for independence from the colonial Portuguese regime in the 1960s and 1970s and the subsequent civil war that followed from 1977 - 1992. Mozambican Liberation forces united in the 1950s and 1960s to form the Liberation Movement for the Freedom of Mozambique (FRELIMO) to fight a guerrilla movement against Portuguese colonial rule (Seibert 2003; Ripoll, Jones, Goncalves, MacGonagle, McKay, et al. 2019). Although the Portuguese maintained control of most major population centres throughout the war, FRELIMO was able to make considerable territorial gains in the northern regions of Mozambique while also undermining Portuguese influence and securing concessions for more favourable conditions for social development (Seibert 2003; Ripoll et al. 2019).

As FRELIMO was able to exert more pressure on the Portuguese colonial government in Mozambique, and, in Portugal popular support for the Colonial Wars diminished following the demise of the authoritarian Estado Novo regime in 1974, FRELIMO and Portugal signed a peace agreement and Mozambique independence was declared on June 25, 1975 (Seibert 2003; Ripoll et al. 2019). Upon declaring independence, FRELIMO established itself as a one party Marxist-Leninist regime and quickly nationalised major institutions (Seibert 2003; Ripoll et al. 2019). Furthermore, in an effort to unify and modernise the country, FRELIMO abolished customary authorities and pushed for a national identity that broke from its ethnic and traditional roots (Seibert 2003; Ripoll et al. 2019).

However, as FRELIMO was establishing its government, it was not without its detractors. South Africa and Rhodesia, which were still under apartheid regimes, felt threatened by FRELIMO who was supporting rebel movements in both countries (Seibert 2003; Ripoll et al. 2019). As such, both Rhodesia and South Africa helped establish and support a counter-revolution movement, the Mozambican National Resistance (RENAMO), to destabilise FRELIMO and support dissident political groups (Seibert 2003; Ripoll et al. 2019). Despite broad initial support, FRELIMO's support base was splintering and many ethnic groups, primarily in the central region of Mozambique, felt alienated by FRELIMO's customary reforms (Seibert 2003; Ripoll et al. 2019). They also felt unrepresented by the FRELIMO government elites running the country from the southern capital of Maputo (Seibert 2003; Ripoll et al. 2019). RENAMO took advantage of this regional, political and ethnic dissidence to establish itself in the central provinces of Manica and Sofala. RENAMO established a support base and recruited members from ethnic groups and political exiles in the central region. A violent power struggle and devastating civil war between FRELIMO and RENAMO followed from 1977 – 1992.

In one of the bloodiest conflicts in post-colonial Africa, more than one million Mozambicans died and five million were displaced during the 15 year civil war (Seibert 2003; Ripoll et al. 2019). Furthermore, the war destroyed critical infrastructure and both sides were responsible for war crimes and crimes against humanity. At the end of the 1980s, support for both FRELIMO and RENAMO dried up with the fall of the Apartheid

regime in South Africa as well as the fall of the Soviet Union and end of the cold war. Under the leadership of President Joaquim Chissano, in 1989 Mozambique drafted a new constitution that effectively ushered Mozambique into a multiparty democracy and initiated the opening of the economy (Seibert 2003; Ripoll et al. 2019). This helped pave the way for peace negotiations between FRELIMO and RENAMO, and in 1992 the Rome Peace Accords were signed officially ending the civil war (Seibert 2003; Ripoll et al. 2019).

Despite the end of the war and the relative peace that followed, tensions between the political parties have endured. In 2013, RENAMO renewed an armed insurgency in retaliation to unfair political systems and a desire for more equitable and fair representation in local and national government (Human Rights Watch 2018; Faleg 2019; Cook 2019). After the elections in 2014, RENAMO failed to recognise the election results citing widespread fraud by FRELIMO leading to an escalation of tensions (Human Rights Watch 2018; Faleg 2019; Cook 2019). Despite temporary cessation of hostilities and agreements between the two political parties that resulted in a new peace agreement in 2018, hostilities and violent attacks continue to the present time (Human Rights Watch 2018; Faleg 2019; Cook 2019).

The impact of the civil war on the research area cannot be overstated. The Nhamatanda district was one of the primary epicentres of the war, was subject to a great deal of conflict and was victimised by extensive land mines. During the war, rural areas of the district were evacuated and raids on villages were common. Ndeja was evacuated in the 1980s and many of the residents were placed under military protection in roadside military camps (Henriques Francisco 2018; Rosário 2018). Many of the elders and current residents of Nguineia were kidnapped and/or were direct victims of violence from both RENAMO and FRELIMO (Henriques Francisco 2018; Rosário 2018). Further complicating the situation to this day, political allegiances in the region are largely split between the two parties and many of the residents are sympathetic to and/or direct supporters of RENAMO (Henriques Francisco 2018; Rosário 2018; Ripoll et al. 2019).

With the more recent resurgence of violence and armed insurgency, the conflict has continued to impact the area. In 2013, RENAMO and FRELIMO reengaged in low-level armed conflict and in response to FRELIMO provocation, RENAMO resumed former military tactics by raiding local health posts and attacking state officials, police and military personnel (Human Rights Watch 2018; Faleg 2019; Cook 2019). This violence spilled over to civilians and the central region of Mozambique became a quasi-military zone where FRELIMO took a heavy-handed approach to subduing and silencing the conflict. Major transport hubs required military convoys; political disappearances and assassinations took place; and military skirmishes spontaneously erupted (Human Rights Watch 2018; Faleg 2019; Cook 2019). Human Rights Watch released a 2018 report, *The Next One to Die*, which documented both the human rights abuses that took place during the renewed insurgency from 2013-2016, and the impact on the central region of Mozambique. This report includes specific abuses from both FRELIMO and RENAMO including cases from the Nhamatanda District and communities bordering Ndeja (Human Rights Watch 2018). Although renewed peace agreements were reached in 2018, the peace deal

remains very tenuous. A RENAMO military junta splinter faction branched off and initiated renewed attacks in 2019 (Human Rights Watch 2018; Cook 2019; Faleg 2019; Ripoll et al. 2019).

The cumulative result of these ongoing conflicts and human rights abuses is that much of the region continues to hold a deep mistrust and fear of the two major political parties and their respective institutions and affiliations (Ripoll et al. 2019). This fear and mistrust manifest itself in a diversity of ways at a local level. During community meetings, local community members are reluctant, or refuse, to criticise government officials. Community members will also acquiesce or accept unfair or prejudicial government demands. This is particularly relevant for land disputes in which government supported businesses push local people off their land without fair compensation. Finally, despite their own personal beliefs, teachers and other school officials often times feel forced to support the dominant local political party for fear of retribution or relocation to undesirable schools or locations.

5.2.4. Socio-cultural demographics

The district of Nhamatanda is primarily made up of two ethno-linguistic groups, the Sena and Ndaou (INE 2017, Ripoll et al. 2019). Although historically the Ndaou made up the majority of the population, more recently and since the onset of the civil war (1977-1992), the Sena has become the larger ethno-linguistic group and 58.8 percent of the population speak Sena as their mother tongue (INE 2017). The Ndaou make up 33.6 percent of the population and speak Ndaou as their mother tongue (INE 2017). About half of the population (49.4 percent) speak Portuguese of which the vast majority (more than 70 percent) are men (INE 2017). Although Christianity is widely practiced in some form (29.4 percent Zion, 26.3 percent Evangelical, 7.6 percent catholic), traditional beliefs and/or no religion is still a large religious affiliation group (29.7 percent) (INE 2017).

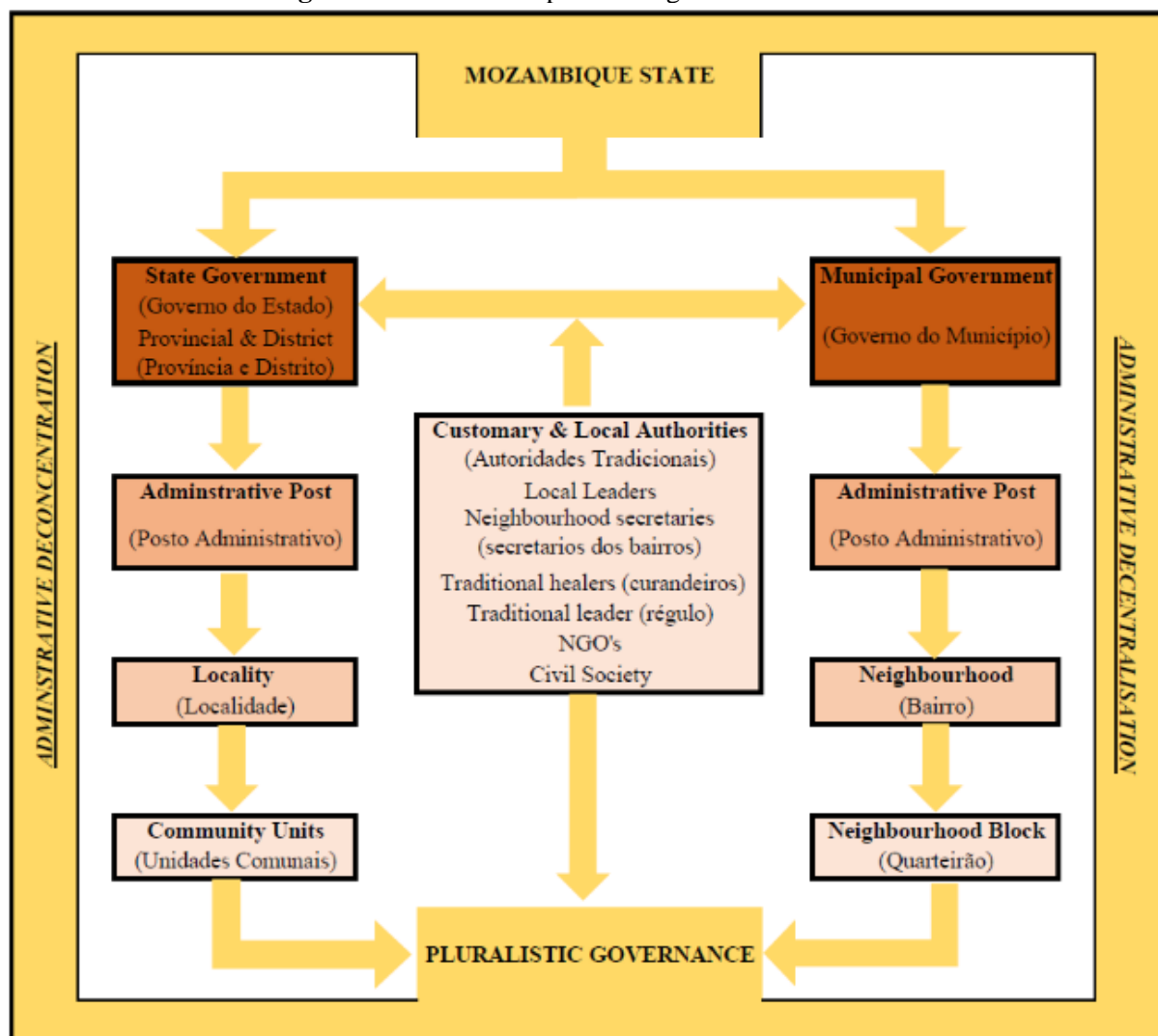
5.2.5. Governance

Mozambique has a pluralistic governance and administrative structure that combines traditional customary authorities with state and local government (see Figure 8: Mozambican pluralistic governance structure) (Rocha & Zavale 2015; Ripoll et al. 2019). In the context of the Nhamatanda district there are three types of administrative jurisdictions that overlap: local government (the town of Nhamatanda Municipality); state government (the District of Nhamatanda); and, local customary authorities (Rocha & Zavale 2015; Ripoll et al. 2019). At a local government level, the city of Nhamatanda is a municipality and locally elects a mayor and cabinet to oversee the town. However, Nhamatanda is also a larger district and extends beyond municipal limits. As a district, Nhamatanda also falls under the jurisdiction of the state government who appoints a District Administrator and district government officials (Rocha & Zavale 2015; Ripoll et al. 2019). Lastly, at a community and village level, representatives and traditional leaders are officially recognised by the constitution and hold important authoritative roles at a local and community level (such as giving land to community members) and serve as important liaisons with government organs (Rocha & Zavale 2015; Ripoll et al. 2019).

All of these administrative structures overlap creating a pluralistic governance structure at times with complementing and at times with competing priorities and administrative mandates.

Although this political structure would seem to suggest a more decentralised form of governance, in reality, formal development is still highly centralised and formal policies and decisions are made outside of the communities they impact (Virtanen 2005). As Virtanen (2005) notes, the legal status and role of community institutions still remains purposefully vague and a serious disconnect exists between the government and rural communities. This is even more pronounced in the central region where long standing political conflicts and mistrust have persisted since the civil war (Ripoll et al. 2019). Further complicating this disconnect and mistrust is poor governance that is characterised by widespread corruption, clientelism, overstretched resources and political patronage in the face of widespread poverty and deprivation (Virtanen 2005; Ripoll et al. 2019).

Figure 8: Mozambican pluralistic governance structure



Source: Adapted from Rocha & Zavale (2015)

5.2.6. Sustainable Development Context

Mozambique is one of the poorest and least developed countries in the world and faces considerable challenges in fostering wellbeing for its population. In its 2019 Human Development Index (HDI), the United Nations Development Program (UNDP) ranked Mozambique 180 out of 189 qualifying countries. This puts Mozambique both below the average for sub-Saharan Africa as well as below the average for the ‘low development’ grouping of countries (UNDP 2019).

Perhaps even more telling of the challenges households and individuals face in Mozambique is the multidimensional poverty index. Unlike the HDI index, which is an aggregate of national level statistics, multidimensional poverty is calculated using microdata from direct surveys at a household level and thus more directly reflects the lived reality of poverty (OPHI 2019). Multidimensional poverty moves beyond looking at poverty as income only and tries to integrate the intensity and prevalence of multiple deprivations in healthcare, education and standards of living that people and households experience on a daily basis (OPHI 2019). According to Oxford Poverty and Human Development Initiative (OPHI 2019), 72.5 percent of Mozambicans experience multidimensional poverty with an additional 13.6 percent vulnerable to multidimensional poverty.

Multidimensional poverty is even higher in the central and northern provinces of Mozambique and in rural areas such as the Nhamatanda District (OPHI 2019). In Nhamatanda, more than 96 percent of the population live in huts made from thatch and mud and less than 5 percent have access to electricity (INE 2017). Less than half the population can read and write and the majority of the population fails to complete primary school (INE 2017). Although approximately 43,000 families, the vast majority the population of the Nhamatanda district, practice and depend on subsistence and small-scale agriculture as their primary livelihood, only 145 hectares of a total 119,200 hectares under cultivation by these farmers use improved irrigation schemes (Governo do distrito de Nhamatanda 2011). Furthermore, the district government only employs eight agriculture extensions officers for the entire district and an estimated 57 percent of farm production is lost post-harvest (Governo do distrito de Nhamatanda 2011). Chronic food insecurity is an ongoing concern for the majority of the 43,000 families that practice subsistence agriculture. Close to 40 percent of children suffer from stunting and more than 15 percent are underweight (UNICEF 2011). Only 50 percent of the population have access to an improved and potable water source and close to 80 percent lack access to basic sanitation (INE 2017). Water borne disease such as cholera and dysentery are common; malaria is widespread; and more than 20 percent of the population is HIV positive (INE 2017; UNICEF 2011).

5.2.7. Ecology and environment

The eastern part of the Nhamatanda district, and more specifically Ndeja, is located in the lower Pungwe River Basin (see Figure 9: Pungwe River basin) (SIDA 2008; Terink & Droogers 2014). In addition to the Pungwe River, the district has a number of other seasonal rivers, tributaries and lakes that make up the lower Pungwe River Basin and contribute to the hydrological potential of the district (Governo do distrito de Nhamatanda

2014). The village of Ndeja is located on the southern banks of one of these rivers, the Metuchira River. The lower Pungwe River basin is characterised by elevations of less than 100 meters and is thus prone to seasonal flooding (SIDA 2008; Terink & Droogers 2014).

The vegetation of the Nhamatanda district is Miombo woodlands and is primarily made up of forest and shrubs that range from thinly wooded to more dense forest in less populated areas (SIDA 2008; Terink & Droogers 2014). The soils in the district are primarily clayey - sandy fluvial dark soils and fertile fluvial soils, both of which provide good agricultural potential (Governo do distrito de Nhamatanda 2011; Terink & Droogers 2014). The Nhamatanda District borders Gorongosa National Park to the north, and the community of Ndeja borders the buffer zone of the park (Governo do distrito de Nhamatanda 2011). As such the district contains a diversity of important fauna and wildlife.

Figure 9: Pungwe River basin



Source: Terink & Droogers (2014)

The Nhamatanda district has a tropical humid climate with average precipitation in the district between 500 and 1000 mm per year, with an average of about 850 mm/year (Governo do distrito de Nhamatanda 2011; Terink & Droogers 2014). The climate is dominated by two primary seasons, a hot and wet rainy season between the

months of October/November and March/April and a drier cooler season that starts in May and continues through September (Governo do distrito de Nhamatanda 2011; Terink & Droogers 2014). The temperature ranges from 18-35 degrees Celsius with an average annual temperature around 26 degrees Celsius (Governo do distrito de Nhamatanda 2011; Terink & Droogers 2014).

Due to advantageous ecological conditions (abundance of hydrological resources, good soils and year round tropical climate) and relative good access to the main transport corridor in the province (EN6), the district of Nhamatanda has been identified as a potential ‘breadbasket’ for the province and broader region (Governo do distrito de Nhamatanda 2011; Terink & Droogers 2014; Gonçalves 2020). It currently has the second largest agricultural output for any district in the province and has been identified as a key district in developing the Beira Growth Corridor (Governo do distrito de Nhamatanda 2011; Gonçalves 2020). However, despite these favourable conditions, due to upstream use and downstream water needs in larger cities near the coast (Beira, Dondo) as well as increasing variance in climatic patterns and rainfall, the Nhamatanda district faces potential long term water shortages (Governo do distrito de Nhamatanda 2011; Terink & Droogers 2014). Furthermore, due to its low elevations and proximity to the Pungwe estuary the region also faces a high risk for natural calamities such as floods (Terink & Droogers 2014). Lastly, despite the fact that landcover is primarily Miombo woodlands, landcover studies show that deforestation and clearing of vegetation is taking place and poses a serious risk for soil fertility (Terink & Droogers 2014).

5.2.8. Cyclone Idai

In March of 2019, Cyclone Idai devastated the central region of Mozambique, as well as areas of Malawi and Zimbabwe. The humanitarian crisis that unfolded in the months after the cyclone had a significant impact on the region and is an important contextual factor for understanding the setting and scope of the project proposal. From a big picture view, more than 2.2 million people were impacted by Cyclone Idai in Mozambique alone (Governo de Moçambique 2019; UNOCHA 2019). More than 700,000 hectares of crops were flooded, impacting more than 500,000 subsistence and small-scale farmers (Governo de Moçambique 2019; UNOCHA 2019). More than 250,000 homes were destroyed and 400,000 people displaced and forced into 162 temporary accommodation centres across the region (Governo de Moçambique 2019; UNOCHA 2019). Close to 1400 schools and 100 health centres were damaged or destroyed as well as critical sanitation and clean water infrastructure (Governo de Moçambique 2019; UNOCHA 2019). The public health situation was compounded by high levels of waterborne diseases, including Cholera and dysentery, as well as high rates of malaria (Governo de Moçambique 2019; UNOCHA 2019). Finally, critical infrastructure and roads were severely damaged thereby cutting off important transport networks. The collective impact of the cyclone significantly exacerbated already high levels of multidimensional poverty and food insecurity brought on by a prolonged drought following the cyclone (Governo de Moçambique 2019; UNOCHA 2019).

The Nhamatanda district, and specifically the eastern part of the district where the proposed project will take place, was one of the most acutely impacted areas of the cyclone. The majority of the lower Pungwe river basin and areas along the Metuchira River were completely inundated and community members were forced to stay in tree tops for multiple days to allow rivers to subside. Large portions of the interior of the Nhamatanda district remained inaccessible for the many weeks following the flooding and the region experienced almost universal crop loss and destruction of homes. Due to the deep and devastating impact of Cyclone Idai, the locality of the Lamego and the Ndeja communities was one of the primary areas targeted by international organisations for large scale aid, food distribution and (removed ‘as well as’) livelihood support in the form of seeds, tools and other essential home goods such as cooking pots, blankets and clothing.

5.3. Organisational background & achievements

Local Development Catalyst Network (LDCN) is a 501 (c)(3) non-profit organisation registered in the United States. LDCN was founded in 2011 by executive director Zachary Lager and its mission is to work together and collaborate with individuals and communities around the world to find locally relevant, economically viable and ecologically sustainable innovations to the diversity of needs and challenges we face as communities and a planet. Our work has primarily been focused on our flagship project in the Nhamatanda District, Sofala Province, Mozambique where we have been working to foster community driven sustainable development for close to ten years.

LDCN’s annual operating budget has averaged around \$20,000/year with the majority of funds coming through our grassroots community fundraising base in the USA. We have also received a number of small grants (less than \$5,000) as well as corporate donations. To ensure that our limited budget goes directly to supporting LDCN’s on the ground projects in Mozambique, LDCN’s executive director has been serving on a voluntary basis since founding LDCN in 2011. Currently, LDCN has a full-time paid project manager in Mozambique as well as a small local support team to help implement and maintain project activities. LDCN is overseen by a five-member board of directors that meets biannually to provide oversight and support for LDCN’s community development initiatives.

Since its founding, LDCN has successfully implemented a number of community driven projects in Mozambique. Our focus areas have been to enhance primary school education, to improve access to clean water and to promote food security through agroecological food production. In pursuit of these goals, we have worked with the community of Ndeja, Mozambique, to build a satellite primary school for more than 300 children (preschool – grade 3). We have hosted a manual borehole drilling workshop and training for a group of 20 community members and subsequently drilled five boreholes throughout the community. To help promote agroecology food production techniques, we have planted and developed a one hectare demonstration farm in the community to serve as an outdoor living classroom to model techniques and technology as well as to share collaborative learning experiences. Our approach has been to implement projects directly with community

members and thus the scale, scope and pace of projects has been driven in large part through community engagement and participation.

In 2019, after Cyclone Idai, LDCN received considerable attention due to our emergency relief efforts and our budget swelled to over \$100,000. This allowed us to expand our community outreach and support in the critical weeks and months that followed the cyclone. Our main achievements were:

- Distributing approximately 10 tonnes of food to 748 families in the month after the cyclone;
- Rebuilding three primary schools in the Nhamatanda District;
- Distributing 1,250 kg of seed to replant local agriculture fields;
- Distributing water filters and water treatment for 10,000 people;
- Rebuilding and replanting our demonstration farm.

These achievements were also implemented through a community based participatory action research (CBPAR) endeavour as part of my MPhil Thesis in Sustainable Development at Stellenbosch University, South Africa. As such, the goal was not only to provide urgent and critical support to the victims of Cyclone Idai but to do so in a way that collaboratively collected data to inform a larger project roll out.

5.4. Research Results

In order to build on LDCN's local community development model and to develop robust evidence to support a broader project roll out that deepens and expands LDCN's activities, LDCN's executive director, Zachary Lager, enrolled part-time in a Postgraduate Diploma Programme in Sustainable Development at Stellenbosch University, South Africa in 2016. He proceeded to the MPhil degree in 2019, and opted to undertake his research via the 'project proposal' format available to students. He chose to develop and implement a community based participatory action research (CBPAR) process aimed at surfacing the enabling conditions, constraints, opportunities and limitations for developing a community based sustainable livelihoods and WEF nexus project in central Mozambique. The research process unfolded through a unique research design based on the scaffolding of the Logical Framework Matrix, insights from an extensive literature review and a transformative, participatory and action oriented methodology. The research process deployed a number of research methods including:

- hosting an informal focus group/agricultural self-help group with local women;
- working with and coordinating activities with local leaders;
- facilitating community transect walks;
- holding periodic community meetings;
- investigating market dynamics of the local food system;
- developing a demonstration farm and analysing resource flows of the demonstration farm; and

- engaging in a cost benefit analysis of different interventions.

The preparation for the research took place in 2018 and 2019, prior to Cyclone Idai, while the implementation took place in 2019 and 2020, after the devastating impacts of the cyclone. As such, the research methods were adapted to meet the immediate and critical needs brought on by the cyclone while at the same time collecting important data to support a longer-term project proposal. In addition to LDCN's organisational history working in the Nhamatanda District, and the unique problem setting described above, the following results and insights from the CBPAR research process provide the backbone for this project proposal.

5.4.1. Enabling Conditions

A number of enabling conditions that could lead to positive outcomes emerged during the research process. Due to the extreme vulnerability brought on by the devastating impacts of Cyclone Idai, there was high levels of motivation within the community to participate in development activities. As such, mobilising community support through local leaders was efficient and effective. This motivation was further enhanced through key incentives offered by LDCN, which focused on providing critical assets needed to cope with and survive the immediate impacts of the cyclone. These primarily included food and key physical capital such as agricultural inputs, tools and other supplies to rebuild critical community infrastructure (such as local schools and boreholes) and individual homes. LDCN's support in the critical six weeks after the cyclone built trust and social capital, key to sustaining motivation and participation in an ongoing process.

Building off this trust and social capital, a generative learning architecture that helped facilitate implementation was developed. The foundation of this learning architecture revolved around a social learning process of collective action and reflection. LDCN's former demonstration farm became a meaningful space for interaction where social learning and experimentation could take place. The women from the focus group along with other community members were able to observe and contribute to the practical application of agroecology activities and technology. This was particularly important for the women for the focus group as they formed an informal agricultural self help group to enhance their food production and food security. Through participatory reflection, the women and community members were able to express interest in specific activities and, in doing so, helped inform potential pathways for future development.

Community leaders reported a strong interest in further engaging in community transect walks as a way to develop future development plans. These transect walks occurred approximately once every three months throughout the research process (Oct 2018, March/April 2019, July 2019, September 2019) and took place by walking along seasonal rivers with local community leaders. Through these transect walks, community leaders were able to become teachers and knowledge holders and demonstrated a capacity to reflect on and identify important livelihood assets and opportunities. This shift in community leaders becoming teachers and knowledge holders was most obvious when they described and spoke about the seasonal variations on how

community members secure their livelihoods. For example, during the rainy season (October – March) when seasonal rivers flood, many community members would practice artisanal pisciculture by raising tilapia in bamboo cages. In the drier months (April – September) community members would take advantage of the increased soil humidity in the seasonal rivers to plant sweet potatoes and other crops. Community leaders not only demonstrated a capacity to explain these practices, but they were also eager to teach the tangible skills associated with them. During one community transect walk in April of 2019, I spent more than four hours with a local community leader and a local fisherman to learn how to make a fish trap out local reeds and bamboo. By giving value to community knowledge, some of the entrenched barriers of communication resulting from large power asymmetries were transcended.

Women from the focus group reported a desire to continue with the agriculture self-help group. Specifically, they reported the positive impact of formal visits to each other's homes and farms. As a collective group, we made monthly visits from May – September 2019 to each woman's farm in order to learn from their individual successes and challenges. These visits were particularly useful when troubleshooting challenges related to access to water for irrigation and the size of vegetable plots. Many of the women had to shift locations and downsize their vegetable production as the dry season set in (August – October) and seasonal rivers dried up. This was an important learning experience and through the monthly visits the women were able to make some important suggestions about how to overcome this challenge. Specifically, they suggested areas where multiple women could work together around hand dug shallow wells near, or in, seasonal rivers. This would help ensure sufficient access to a minimum amount of water needed to maintain a small home garden. Another key discussion area revolved around the size of vegetable plots. Many of the women were super eager when we started the focus group and planted relatively large plots of vegetables (500 – 1,000 m²). The women quickly realised the quantity of work and water that was needed for the vegetable gardens and many downsized their vegetable gardens to more manageable sizes. The large levels of crop loss further emphasized this point. Finally, these monthly visits also enhanced accountability and transparency as the women were able to share in the growth of each other's farms. In our last focus group meeting, (October 2019) all of the women reported that one of the main motivators to maintain their garden was to avoid the embarrassment of having the “worst” garden.

A final significant enabling condition was the presence of financial resources. LDCN experienced an increase in project funding after Cyclone Idai. This increase in funding allowed us to connect important reflections with tangible project outcomes. For example, we were able to purchase small pedal powered pumps and 500 litre water tanks for each of the women of the focus group to help irrigate their vegetable gardens. These purchases were made based on feedback and discussion with the women and connected reflections with tangible and generative outcomes. At a broader community level, we were able to maintain broad community support and participation in community meetings by rebuilding three local schools. This contributed to sustained participation in the research process and community development activities.

5.4.2. Constraints and challenges

Despite these enabling conditions, a number of constraints and challenges also arose during the research process. As it is located more in the interior of the district and away from roadside development/infrastructure, the broader community of Ndeja is relatively isolated from important markets (the demonstration farm is about 15 km from the largest local market). During the rainy season (November – March/April) when seasonal rivers swell and flood, the only way to access the community of Ndeja is by foot or by bicycle. The walk takes about two to three hours and the ability to transport large quantities, or heavy and bulky items, is almost impossible. Furthermore, none of the women in the focus group had access to a bicycle. In the dry season, renting a bicycle or motor bike is equivalent to about \$3.00 to \$5.00 (USD) which is more than the value of the quantity of produce that can normally be transported. As such transporting agricultural produce to roadside markets was physically demanding, time consuming and/or expensive. Selling agriculture produce in the community and to outside vendors with their own transportation resulted in below market prices. In addition to the lack of markets and transportation, the women from the focus group also reported high levels of in-field and postharvest losses at a farm level. This was most obvious for tomatoes, a crop which women reported losing more than 50 percent of their production due to rot.

Local social dynamics also constrained some of the opportunities to overcome these challenges. The women preferred to work as individuals and were hesitant to combine resources, work together on a cooperative farm and collectively sell their produce. They reported misgivings about jealousy and the potential for uneven contributions of members leading to unfair distribution of benefits. Although the women also reported being open to LDCN serving as a middleman to collectively buy and sell individual production from each of the women and subsequently distribute benefits accordingly, they also expressed high levels of doubt that a community member or group member could eventually take over this responsibility. This would seem to suggest low levels of trust and management capacity, both of which are potential hurdles for horizontal integration and collective action.

Another key constraining social dynamic that arose during implementation is gender disparity in the community. Agricultural assets and inputs are generally controlled by men. In working with the women and providing inputs for the women in the focus group, some of the husbands wanted to assert their control by receiving and controlling the use of these inputs. In one extreme case, the husband of one of the women sold the inputs without consulting his wife or LDCN.

Finally, there were high levels of variance in the effectiveness of collaboration with local leaders. Whereas some leaders displayed commitment, transparency and accountability during collaborative activities, others proved to be more evasive, less forthcoming and less dependable. The research process highlighted the potential for elite capture of development processes by local elites and the difficulty of implementing a formal planning procedure due to the inconsistent and unreliable participation of local leaders. Some of these challenges manifested

themselves with one of the local leaders when coordinating repairs on one of the schools and organising a school feeding scheme using the produce from LDCN's demonstration farm. More specifically, one community secretary continually sought to extort more money than what was agreed upon with LDCN for making school repairs. This created an uncomfortable standoff and the final finishing details of the building were never completed by the community secretary in a satisfactory manner.

When this specific situation and the general role of the locally appointed village or neighbourhood secretary ("secretario do bairro") was discussed and reflected upon with other community members during informal interviews, many of the community members reflected that positions of leadership are not always motivated by civic duty but rather by informal benefits and patronage that oftentimes accompany them. This form of patronage is oftentimes accepted by community members so long as the leader is fulfilling his or her duty. In the absence of benefits, or when there is a lack of accountability or consequences, local leaders may choose to act, or not act, in potentially self-serving ways. In these cases when the local leader chooses not to engage or does so in self-serving ways, motivation from the broader community can quickly dissipate. This provokes a key challenge of how to balance patronage and leadership and the complexity of community social dynamics that accompany this balance.

One stopgap solution that was deployed and offers a potentially longer term strategy to address some of these constraints, is to foster greater community accountability and peer to peer accountability. This solution was seen at both a small social group level (the women focus group) as well as at a broader community level. At a more social group level, the women from the focus group kept each other accountable during our informal site visits to avoid embarrassment of having the worst garden. At a broader community level, and in the context of working with the locally appointed secretary on the school repairs, tasks and work always proceeded more quickly and efficiently around the times when community meetings were scheduled. Whereas my relationship with the community secretary was an opportunity for the secretary to develop a relationship based on patronage and economic incentives/favours, the secretary's relationship with the community was based more on leadership and accountability. To "save face" at community meetings during which the school rebuilding process was discussed, the secretary would make sure a sufficient amount of work was completed in the immediate days before and after a community meeting. This more peer level accountability is a key observation of how to enhance the transparency and efficacy of local leadership development and accountability.

5.4.3. Insights and Opportunities

In addition to highlighting some of the enabling conditions as well as some of the challenges and constraints, the research process also led to a number of insights and opportunities for enhancing positive project outcomes. In particular, a number of important insights and opportunities surrounding local livelihood strategies emerged. By engaging in a research process that took place over ten months, one of the key insights was the seasonality

of livelihood strategies and season specific livelihood opportunities. Some examples of potential seasonal livelihood opportunities that emerged through our community transect walks and focus group include:

- Out of season, or end of season, vegetable production (tomatoes sold in December can be sold for more than five times the value of the same quantity and quality of tomatoes in June);
- Extending the maize (local staple) growing season through small scale irrigation systems on seasonal rivers or using shallow wells near seasonal rivers; and
- The potential to enhance traditional methods of pisciculture by capturing and retaining water during the rainy season.

In addition to these more seasonal opportunities, our focus group and demonstration farm also highlighted the potential for agroforestry. Women from the focus group were particularly interested in agroforestry due to the potential to grow their own firewood (cooking fuel) thereby avoiding the need to travel long distances to cut and fetch firewood. Our cost analysis and resource flow analysis also supported the potential for agroforestry as it had lower input costs and lower water needs than developing an equivalent size vegetable garden while at the same time producing large quantities of food staples (primarily cassava and beans) and important agroecological biproducts such as biomass for mulching and composting.

Women from the focus group also expressed interest in the idea of conserving and refining agricultural produce. Sesame and sunflower are common crops produced during the rainy season and could be used to locally produce oil. Currently, community production of sesame and sunflower is sold to bulk buyers in the district capital of Nhamatanda (about 40 km from Ndeja). These buyers (primarily Indian and Pakistani businessmen) buy production at very low costs and subsequently refine or resale the primary production domestically and internationally. As such, profits are relative small for community members especially due to the distance and transportation costs to get products to Nhamatanda. Refining the sesame or sunflower in the community could provide value added benefits to local production including increased income or access to cheaper and higher quality cooking oil. Furthermore, the biproducts of producing oil locally could contribute to improved local poultry production. Currently, most household raise 10-15 chickens by allowing them to graze and roam around the homestead. Producing a high quality seed cake from the left over seed after it has been pressed for oil could enhance local chicken production and open the possibility to expand production methods. Finally, we also experimented with developing a solar dryer to conserve fruits and vegetables such as tomatoes and mangos. Our initial experimentation with the solar dryer suggests that during the hot summer months (November – March), the sun is intense enough to dry key crops with a simple homemade solar dryer. Whereas mangos offer the potential for income generation by reselling them at roadside markets in the mango off season (May - September), drying tomatoes offers the potential to avoid farm level loss and enhance access to tomatoes when they are most expensive (November – April).

Finally, a key insight from working with the women's agriculture self help focus group was that our extension services contributed more to food security and social capital than income generation. Although some of the women reported earning a small income from their vegetable growing activities, they did not meet their expectations of what they believed they could have earned. When discussing and reflecting on the benefits of the agriculture self-help focus group, the majority of the women reported the primary benefit as an increase in consuming a greater quantity and diversity of vegetables than in previous years. They also reflected their desire to continue with the group and to work with LDCN thereby reflecting trust and social capital through relationship building. Ultimately, the women believe there is still an opportunity to increase their income, however the inputs and design of their gardens would require greater investment of time and resources. One of the key discussion points for the future is to better calibrate expectations with the particular garden design. The majority of the women (two thirds of the focus group) wanted to continue with growing a home food security garden while continuing to build towards a larger garden capable of generating a greater income.

5.4.4. Limitations & Further Investigation

While the research process did highlight a number of insights and opportunities, it also surfaced some limitations that require further investigation. A more technical ecological impact assessment would enhance understanding of local ecological thresholds and the potential for expanding and enhancing a variety of local livelihood strategies. This more technical assessment would be particularly useful for understanding and analysing hydrological resources and flows and subsequently to develop safe thresholds for their use. The opportunities for small scale sand dams on seasonal rivers and ground water extraction are two specific areas that would benefit from more technical analysis.

Another limitation that emerged from the research process was the inability to develop vertical linkages and collaborative relationships with larger more established organisations and stakeholders in the region. Throughout the research process, LDCN was successfully able to develop horizontal linkages with other community based and community-oriented organisations, however, this relationship building proved to be more difficult when jumping scales. When these vertical linkages did take place, it was due to a utilitarian or pragmatic need of the larger organisation and the relationship was not durable or long lasting. In order to address this limitation, we are currently seeking out a funding and implementation partner that may help foster these linkages as part of a longer term regional development process.

Finally, a last consideration that demands further investigation is understanding the broader external factors that contribute to the vulnerability of the region. Cyclone Idai highlighted the extreme vulnerability of the region, however droughts and other geopolitical and socio-ecological factors have contributed an enduring vulnerability that in turn has led to the persistence of extreme multidimensional poverty. A greater understanding and quantification of these factors would help to better situate research findings and this project proposal. By

combining an analysis of these more regional and global factors with more subnational level findings, more nuanced and robust comparisons across a greater diversity of locations becomes possible.

6. Chapter 6: Project proposal executive summary & vertical logic

6.1. Executive Summary

The goal of this project proposal is to develop and foster a collaborative and nimble community development model that fosters the necessary resources, assets, skills, agency and relationships needed to catalyse sustainable development, reduce multidimensional poverty and promote a more sustainable and locally relevant ecosystem governance arrangement in rural central Mozambique. To reach this goal, the project is designed to enhance the capacities and capabilities of the broader community of Ndeja and to access and utilise critical resources and assets in the water, energy and food nexus thereby contributing to local livelihoods and a positive shift in local quality of life. The guiding long-term philosophy for our approach is to build a foundation on which an adaptive comanagement ecosystem governance arrangement can emerge by empowering and giving agency to the local community to take a more direct role in guiding community interventions and achieving long term sustainable development goals.

To achieve these goals, our methodological approach is to start with relatively small yet attainable short-term capacity building initiatives that address immediate community needs. Initially, these initiatives will be driven primarily by LDCN project leadership. As the project progresses, we will utilise the outputs and opportunities that are achieved through the capacity building activities to subsequently widen and deepen the scope of project activities to enhance community capabilities to drive local development. By engaging in leadership development, providing extension services, building networks and communities of practice and fostering social learning, the goal of the capability stage is to comanage and deploy WEF nexus resources in a diversity of ways that are adapted to address local needs. In doing so, the project will help to surface the socio-ecological conditions needed for a locally relevant ecosystem governance structure to emerge. The project is designed to take place over five years but is embedded in a longer development plan to achieve the United Nations Sustainable Development Goals by 2030.

6.2. Logical framework matrix project proposal

The LFM serves as a condensed summary of the project's goals and objectives and how the project will achieve and measure progress towards those goals and objectives (see Table 8: Project proposal logical framework matrix (LFM)). To more accurately reflect the project planning process and final project design, two structural changes were made to the LFM. First, the objectives row was changed to the capacity building row, and the outcomes row was changed to the capability building row. The project is designed around a two stage capability building approach in which beneficiaries need both the capacity, or the resources, assets and skills, for development as well as the capability, or agency, freedom and relationships, to deploy those resources and skills in innovative, imaginative and meaningful ways. The first stage of the project, the capacity building stage, is focused on equipping the community of Ndeja with necessary livelihood assets in the WEF nexus. The second stage of the project, the capability building stage, is then focused on providing a suite of services to help

beneficiaries realise different ways those livelihood assets can be utilised to stimulate an improved quality of life. As such, the capacity building stage reflects the more immediate objectives while the capability building stage reflects the more medium term outcomes.

The second change to the LFM is redefining the assumptions column as a design principles column. In traditional uses of the LFM, the assumptions column is focused on highlighting potential problematic externalities. Although this a useful and important step for project planning and for monitoring and evaluating (M&E) progress during project implementation, it does so in a more static and deterministic way that views externalities as an unavoidable consequence rather than a limiting situation. Shifting the assumptions column towards design principles, then offers a project planner a set of guiding logics to help deal with problematic externalities when they do arise. In doing so, project principles reflect and absorb the inherent assumptions and uncertainty that come with project implementation, but in a way that is action oriented and designed to help surface and foster insight into the enabling conditions needed to overcome them. As such the design principles are not static or fixed but rather are an evolving set of guiding logics that unfold during project implementation. This allows for a more flexible and adaptable approach capable of achieving project goals and transcending problematic assumption and externalities.

The following LFM integrates these structural shifts to provide the scaffolding and structure for the project proposal. The LFM also builds off the nuanced understanding of the problem setting that comes with ten years of experience of living and working in the target area. Finally, the LFM is informed by the results of a community based participatory action research (CBPAR) project aimed at surfacing the enabling conditions, constraints, opportunities and limitations needed to foster sustainable development in the WEF nexus by promoting and building local livelihoods and fostering a more locally relevant, collaborative and adaptive form of ecosystem management. Immediately following the LFM is a more detailed description of the capacity building objectives and capability building outputs.

Table 8: Project proposal logical framework matrix (LFM)

	<u>NARRATIVE SUMMARY</u>	<u>INDICATORS</u>	<u>MEANS OF VERIFICATION</u>	<u>DESIGN PRINCIPLES</u>
PROJECT GOALS	The goal of the project is to foster the conditions needed for a locally relevant, ecologically sustainable and financially viable form of adaptive comanagement to emerge and contribute to flourishing futures for rural Mozambican communities.	Foster improved livelihood outcomes in the water - energy - food nexus	Multidimensional Poverty Survey (MDP survey)	1. Start small and progressively expand the breadth and depth of interventions: <ul style="list-style-type: none"> • <i>Build capacity to enhance capability.</i>
		Protect, conserve and regenerate ecosystem conditions and access to ecosystem services	Ecosystem Impact Analysis (EIA)	2. Build a meaningful and locally relevant learning architecture: <ul style="list-style-type: none"> • <i>Integrate social learning/participatory monitoring & evaluation (M&E);</i> • <i>Use a multiple evidence based approach to enhance credibility;</i> • <i>Develop meaningful spaces of interaction and demonstration;</i> • <i>Foster peer to peer learning (horizontal linkages).</i>
		Foster innovative improvements in the processes and institutions that support collaborative governance and adaptive capacity	Ongoing monitoring and evaluation developed through community consultation and programme reflection and evaluations.	3. Foster local livelihoods and entrepreneurship: <ul style="list-style-type: none"> • <i>Transition from external incentives towards internal motivation.</i>
				4. Build leadership networks and social capital: <ul style="list-style-type: none"> • <i>Embed accountability and transparency when working with local leaders;</i> • <i>Empower women and address gender disparities;</i> • <i>Foster vertical linkages with regional stakeholders.</i>
				5. Ensure financial resources and economic viability

CAPACITY BUILDING STAGE	<u>NARRATIVE SUMMARY</u>	<u>INDICATORS</u>	<u>MEANS OF VERIFICATION</u>	<u>DESIGN PRINCIPLES</u>
	Improve and expand access to meaningful vocational training in WEF Nexus.	30+ community members trained in manual borehole drilling	Ongoing M&E project reports	<ul style="list-style-type: none"> Start with a pilot group and expand outwards; Incentivise participation with livelihood assets; Embed ongoing collective reflection in trainings; Host trainings on demonstration sites; Build on local knowledge;
		75-100 women trained in agroecology food production	Ongoing M&E project reports	
		75-100 women trained in agroforestry and tree seedling production	Ongoing M&E project reports	
	Inspire and educate youth environmental custodians.	350 youth participate in school based agroecology activist education programme	Ongoing M&E project reports	<ul style="list-style-type: none"> Combine science and traditional knowledge; Focus on livelihood opportunities; Host practical activities on demonstration sites; Foster participation from school leaders and teachers.
		School forest and conservation area is established in partnership with local schools	Ongoing M&E project reports	
		Youth leaders elected to be local environmental custodians	Ongoing M&E project reports	
	Improve community capacity, including programming, physical infrastructure and access to tools and equipment, needed for community WEF nexus security.	Local schools have access to clean water, improved sanitation and solar energy	Ongoing M&E project reports	<ul style="list-style-type: none"> Start with implementation at schools as a community demonstration and build outwards; Combine implementation with vocational training; Foster participation of local leaders; Build on local knowledge;
		Local community has access to equipment and tools for manual borehole drilling	Ongoing M&E project reports	
		Community tree nurseries are built	Ongoing M&E project reports	
		Community training farms are designed and equipped with necessary inputs for food production	Ongoing M&E project reports	
		School feeding scheme established in partnership with school leadership	Ongoing M&E project reports	
	Enhance the capacity of local leaders and the community to participate in development planning and local ecosystem governance.	Local development advisory council is established in partnership with the local community	Ongoing M&E project reports	<ul style="list-style-type: none"> Ensure gender equality; Clearly define roles and expectations including ways to ensure accountability and transparency; Incentivise ongoing participation through livelihood assets;
		Community map of local livelihood assets created with community leaders	Ongoing M&E project reports	
		Baseline data collected and discussed with community leaders and shared with the broader community	Ecological Impact Assessment and Multidimensional Poverty Survey	

		Locally relevant thresholds and operating procedures (rules and regulations) are agreed upon with the community for development planning and ecosystem conservation	Ongoing M&E project reports	<ul style="list-style-type: none"> Combine local knowledge and scientific data to produce locally relevant procedures and thresholds.
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CAPABILITY BUILDING STAGE	<u>NARRATIVE SUMMARY</u>	<u>INDICATORS</u>	<u>MEANS OF VERIFICATION</u>	<u>DESIGN PRINCIPLES</u>
	Improve household access to WEF nexus resources.	75% of households have access to improved water source (borehole water) that is within 1 km or 30 min walk	Multidimensional Poverty Survey	<ul style="list-style-type: none"> Shift from external incentives to internal motivation; Shift demonstration sites and spaces of interaction from community spaces to individual households; Build in participatory monitoring and evaluation with local leaders and community beneficiaries; Foster peer to peer social learning and accountability.
		Household dietary diversity is improved	Multidimensional Poverty Survey	
		Acute food shortages decrease	Multidimensional Poverty Survey	
		Access to improved electricity (solar power) increases	Multidimensional Poverty Survey	
		Decrease in the distance to collection and quantity of firewood needed for cooking	Multidimensional Poverty Survey	
	Strengthen and support local networks and local communities of practice.	Women have increased opportunities for group membership in formal and informal associations, self help groups and/or entrepreneurial groups.	Multidimensional Poverty Survey	<ul style="list-style-type: none"> Foster peer to peer networks; Build livelihood and entrepreneurial opportunities; Continue to foster meaningful spaces for interaction and peer to peer learning.
		Local drill team has been legally recognised and has a formal organizational structure	Multidimensional Poverty Survey	
	Improve local agroecological conditions on community demonstration sites and conservation areas.	Soil quality and soil biology on community training farms has improved	Ecological Impact Assessment	<ul style="list-style-type: none"> Use multiple evidence based approach by integrating scientific data collection; Foster participatory monitoring and evaluation with local leaders; Disseminate and reflect on results with the community.
		Biodiversity is improved in community conservation areas and on community training farms	Ecological Impact Assessment	
		Land cover loss is stabilized or has improved	Ecological Impact Assessment	
	Increase gender equality in the local agricultural system and empower women community leaders.	50% of local development advisory council are women	Ongoing M&E project reports	<ul style="list-style-type: none"> Ensure gender equality by empowering participation by women; Foster peer to peer learning and space of interaction; Ensure accountability and transparency.
		Women have increased access, credit, ownership and decision making power in relation to household agricultural assets and production decisions	Multidimensional Poverty Survey	

		Women actively take part in developing sustainability/transitions plans and decision making surrounding community commons (programming, infrastructure, tools and equipment) used to support community WEF nexus security	Ongoing M&E project reports	
	Develop a local innovation niche to enhance economic opportunities for the local community.	Decrease in transportation costs and travel time to local and regional markets (increase access to affordable transportation options)	Multidimensional Poverty Survey	<ul style="list-style-type: none"> • Shift from external incentives towards internal motivation for choices and participation; • Foster peer to peer learning, spaces of interaction and collective reflection; • Build on local assets and skills; • Nurture innovation and entrepreneurial skills; • Ensure accountability, transparency and opportunities for women.
		Potential income generating activities are identified and demonstrated on local training farms.	Ongoing M&E project reports	
		A minimum viable product business plan is developed for key incoming generating activities	Ongoing M&E project reports	
		Access to credit, technology and other agricultural inputs for local innovations is improved	Multidimensional Poverty Survey	
	Improve the capability of local leaders to participate, communicate and follow through on agreed upon local development and ecosystem governance plans.	75% of boreholes are maintained and operational at any given moment	Ecological Impact Assessment (and ongoing monitoring and evaluation project reports)	<ul style="list-style-type: none"> • Shift from external incentives towards internal motivation for participation; • Establish community mechanisms for accountability and transparency; • Combine traditional knowledge and scientific data to enhance credibility and relevance of data; • Ensure women participation in planning, monitoring and evaluating; • Embed critical and collective reflection.
		Ecological thresholds and operational procedures are respected	Ecological Impact Assessment (and ongoing monitoring and evaluation project reports)	
		Local leaders/local development council participates in yearly monitoring and evaluation of project interventions	Ongoing M&E project reports	
		A long term community sustainable development plan is created and agreed upon based on project activities	Ongoing M&E project reports	
		A transition plan is created for the school agroecology activist & education programme by local school leaders and youth environmental custodians	Ongoing M&E project reports	

ACTIVITIES & INPUTS	ACTIVITIES	TIME FRAME	RESPONSIBLE AGENTS
	Community Consultation	Year 1 - 5	
	Community Mapping	Year 1 & 2	LDCN Field Staff and Community
	Project Design Community Feedback	Year 1	LDCN Field Staff and Community
	Ongoing Participatory M&E	Years 2 - 5	LDCN Field Staff and Community
	Baseline Data Collection	Year 1 & 5	
	Ecological Impact Assessment	Year 1 & 5	External Consultant/Graduate Students
	Multidimensional Poverty Survey	Year 1 & 5	External Consultant/Graduate Students
	Manual Borehole Drilling Campaign	Year 1 - 4	
	Manual Borehole Drilling Training	Year 1	LDCN Water Manager, External Trainer, Community Drill Teams
	Community Drilling	Year 2 - 4	LDCN Water Manager, Community Drill Teams
	Continued Learning	Year 2 - 3	LDCN Water Manager, Community Drill Teams
	Organisational Development	Year 3 - 4	LDCN Water Manager, Community Drill Teams
	Agroecology Livelihood Training	Year 2 - 4	
	Establish Livelihoods Training Gardens	Year 2 - 3	LDCN Agroecology Manager
	Vocational training programme	Year 2 - 4	LDCN Agroecology Manager
	Local school feeding scheme	Year 2 - 4	LDCN Agroecology Manager
	Agroecology Youth Activist and Education Programme	Year 2 - 4	
	Agroecology training for local schools	Year 2 - 3	LDCN Agroecology Manager
	Build school tree nursery	Year 2 - 3	LDCN Agroecology Manager & School Coordinator
	Youth conservation activities & tree planting	Year 2 - 4	LDCN Agroecology Manager & School Coordinator
	Extension Services	Year 3 - 5	
	Agroecology livelihood extension	Year 3 - 5	LDCN Extension Officer
	Agroforestry outreach programme	Year 3 - 5	LDCN Extension Officer & Women Agroecology Graduates
	Market & Product development	Year 4 - 5	LDCN Extension Officer & LDCN Agroecology Coordinator

Leadership Development, Knowledge Sharing & Regional Network Building	Year 3 - 5	
Agroecology School Coordinator Meetings	Year 3 - 5	LDCN Agroecology Manager & School Coordinator
Agroecology Peer Mentor Programme	Year 3 - 4	LDCN Agroecology Manager & Women Agroecology Graduates
Horizontal Integration of Women Farmers	Year 5	LDCN Agroecology Manager & Women Agroecology Graduates
Local Sustainable Development Council	Year 3 - 5	LDCN Project Manager and Community Leaders
Network building with regional stakeholders	Year 4 & 5	Full Implementation Team
Develop community training manuals	Year 5	Full Implementation Team
Publish academic articles	Year 5	LDCN Project Manager

INPUTS	DESCRIPTION	DETAILS	TIME
Human Resources	Positions	Roles and Expectations	Time
Director	Project Manager	Project Oversight	Year 1-5
Field Staff	Water Coordinator	To facilitate and coordinate manual borehole drilling programme	Year 1-5
	Agroecology Manger/Trainer	To oversee agroecology training and extension services	Year 1-5
	3x Agroecology Extension Field Officers	To ensure implementation of project activities at a community level	Year 2-5
	4x guards	To ensure materials, equipment and other project resources are safe and secure	Year 1-5
Administration	Project Administrator	To ensure external reporting guidelines are met and to support the project manager on administrative tasks	Year 1-5
	Accounting Services	To ensure financial accountability and financial reporting standards are met	Year 1-5

	Technical Consultants	Graduate Student Research Assistants	To facilitate multidimensional poverty survey	Years 1 & 5
		Consultant - Ecological Impact Assessment	To conduct ecological impact assessment	Years 1 & 5
		Training Specialist - Manual Borehole Drilling	To facilitate manual borehole drilling training	Year 1
	Physical Resources (Equipment & Supplies)	Description	Details	Time
	Monitoring and Evaluation	Data collection equipment and tools	To facilitate the collection of local data	Year 1-5
		Office Supplies	General office supplies used for the collection and reporting of data	Year 1-5
		Computer	For storage, computing, analysing and reporting data	Year 1-5
	Training Farm Inputs	Irrigation Equipment	Pumps, pipes and storage of water	Years 1-3
		Agroecology Inputs	Seeds, compost, fertilisers, pest control, tree seedling production...etc.	Years 1-5
		Building materials	Lumber, roof panels, cement and other building materials	Years 1-3
		Hand Tools	Tools with a unit cost of less than \$500	Years 1-3
		Equipment & Machinery	Equipment with a unit cost of more than \$500	Years 1-3
		Storage	To safely and securely store all equipment, materials and tools	Years 1-3
	Manual Borehole Drilling	Hand Tools	Tools with a unit cost of less than \$500	Year 1
		Drilling Equipment	Equipment with a unit cost of more than \$500	Year 1
		Pumps	Hand pumps and solar pumps needed to pump water from boreholes	Year 1-5
		Inventory and Supplies	Pipes and other supplies needed for boreholes and borehole maintenance	Year 1-5
	Education and Vocation Training Programmes	Hand Tools	Tools with a unit cost of less than \$500	Years 2-4
		Bicycles	For local transportation	Years 2-4
		Food	Food to be served during workshops and activities	Years 2-5

		Office Supplies	General office supplies used for workshops and training	Years 2-5	
		Cooking equipment	Pots, pans and other kitchen supplies need to prepare and serve food	Years 2 & 3	
	Extension Services	Agroecology Inputs	Seeds, compost, fertilisers, pest control, (etc) to support women graduates of agroecology training programme	Years 3-5	
		Building supplies	For community tree nurseries	Years 3-5	
		Solar Panel Systems	To be distributed as part of agroforestry outreach programme	Years 3-5	
	Market & Product Development	Storage Equipment	TBD based on programme activities	Year 4 & 5	
		Processing Equipment	TBD based on programme activities	Year 4 & 5	
	Operations	Vehicles	1 truck, 1 ATV & 3 motorbikes	Year 1-5	
		Office Supplies	For recording keeping and reporting	Year 1-5	
		Computer	For record keeping and reporting	Year 1-5	
	Financial Resources*5-year total budget\$1,500, 175(USD\$)				
*For a detailed budget summary see Appendix B: Proposed Budget Summary					

Source: Author's Own

6.3. Project objectives

In order to approach our long term vision of catalysing a locally relevant form of adaptive comanagement that improves access to WEF nexus resources, promotes local livelihoods and respects ecological thresholds, the project is broken down into a number of pragmatic short and medium term objectives. These objectives are organised based on the project's capacity–capability implementation strategy in which the skills, assets and knowledge developed during the capacity building stage are subsequently deployed to amplify and extend outcomes during the capability stage. As such, each stage has a unique set of objectives that require different methods and levels of support and which take place on varying time scales.

6.3.1. Capacity building objectives

The capacity building stage has four main objectives that are broadly focused on developing the foundational skills, knowledge and assets needed to secure WEF nexus resources, to promote local livelihoods and to implement capability building interventions. These short term and pragmatic objectives are a point of departure for project activities and thus represent necessary, but not sufficient conditions, needed to achieve our broader project vision. The capacity building objectives are:

1. Improve and expand access to meaningful vocational training in WEF Nexus.

By improving and expanding access to meaningful vocational training in WEF Nexus, LDCNs goal is to develop and foster the necessary skills, assets and knowledge needed to improve safe and sustainable access to water, energy and food. Vocational training will be implemented through practical, experiential and tangible skill building activities in which the physical outputs of the various trainings will contribute to immediate short term community needs. Vocational trainings will specifically focus on training a local drill team in manual borehole drilling and on providing agroecology training for local women. Trainings will take place in and on public spaces and for the benefit of the broader community. LDCN will build on the skills and knowledge gained from the vocational training during the capability building stage of the project as part of a broader community extension programme.

2. Inspire and educate youth environmental custodians.

LDCN will work with local schools to develop an agroecology youth activist and education programme to enhance environmental awareness and education. As part of the programme, youth will help care for and plant tree seedlings in conservation areas, spread environmental knowledge to the broader community and participate in practical, fun and engaging environmental awareness activities. The end goal is to encourage youth to become environmental custodians who will help to rehabilitate, protect and conserve local ecosystem services.

3. *Improve community capacity, including programming, physical infrastructure and access to tools and equipment, needed for community WEF nexus security.*

As a part of the manual borehole drilling training, community participants will drill boreholes in key community locations including schools, training farms and conservation areas thereby providing access to clean water in critical locations. As part of the agroecology training, groups of local women will be trained in community training gardens designed and equipped with the necessary inputs to support community food production. The produce from the gardens will go to supporting a local school feeding scheme that will be established and comanaged between LDCN and local school leaders. Each community training garden will also support a local tree nursery that is connected the agroecology youth activist and education programme.

4. *Enhance the capacity of local leaders and the community to participate in development planning and local ecosystem governance.*

LDCN will work with the local community to establish a participatory monitoring and evaluation process for project activities and interventions. This participatory process will include integrating local knowledge and scientific data through a participatory community mapping exercise and through collaboratively collecting baseline data. The results of this process will provide insight to refine project activities and to develop locally relevant benchmarks and indicators for future planning and ecosystem management during the capability building stage of the project. To help guide this process, LDCN will consult and work with a local development advisory council made up of local leaders and will foster broader community feedback through regular community meetings.

6.3.2. Capability building outputs

The capability building stage builds on the skills, knowledge and assets developed during the capacity building stage to amplify and extend the impact of project interventions. In addition to the capacity for development (skills, knowledge and assets) a person or community also needs the capability for development, or the freedom, agency and networks/relationships, to deploy those capacities in different conditions and for different purposes. As such, the focus of the capability building stage is to build on the outputs of the capacity building stage by supporting community members through a suite of services and opportunity building activities. In doing so, the outputs of the capability stage are:

1. *Improve household access to WEF nexus resources*

LDCN will extend and amplify the skills and knowledge developed through vocational training programmes in order to enhance household access to WEF nexus resources. LDCN will work with the local drill team to develop a manual borehole drilling outreach programme to secure access to borehole water for at least 75% of the target region (10,000+ people). LDCN will also provide a suite of services for the women graduates of the agroecology

training programme to develop food security home gardens. Women graduates will also have the opportunity to participate in the agroforestry outreach programme to gain access to solar energy lighting systems while reducing the time, distance and quantity of firewood needed for cooking.

2. Strengthen and support local networks and communities of practice

Through participation in LDCN's vocational and extension programmes, community members and project beneficiaries will have increased opportunities for participation and membership in formal and informal self-help groups. These self help groups provide mutual peer to peer support to overcome relevant challenges through collective action and solidarity. These self help groups and communities of practice are specifically related to LDCNs proposed support of women farmers and manual borehole drilling teams.

3. Improve local agroecology conditions on community demonstration sites and conservation areas

To demonstrate the value of agroecological practices for conservation and rehabilitation of local ecosystems, LDCN will collaboratively collect data on soil quality, soil biology, biodiversity and land cover with experts and community members. This data will be combined with local knowledge to validate and foster external support from regional and international stakeholders for ongoing project sustainability and expansion.

4. Increase gender equality in the local agriculture system and empower women community leaders

Through our agroecology extension programme, LDCN will support women, empowering them to increase their control, voice, and ownership in agricultural assets and decision making at a household and community level. LDCN will also ensure equitable gender participation in community planning and leadership development activities.

5. Develop a local innovation niche to enhance economic opportunities for the local community

LDCN will foster a local innovation and livelihood niche that contributes to socio-economic upliftment of the local community. To do so, LDCN will identify and demonstrate viable agroecology business opportunities, improve access to local and regional markets and provide opportunities to access credit for appropriate and locally relevant technologies. The goal of developing this innovation niche is to build on local capacity and offer community members opportunities and choices to enhance local livelihood strategies and build their capability to achieve positive outcomes.

6. Improve the capability of local leaders to participate, communicate and follow through on agreed upon local development and ecosystem governance plans.

LDCN will work with local leaders to collaboratively monitor and evaluate activities as well as to design locally relevant mechanisms to ensure ongoing accountability and sustainability of project outcomes. Locally relevant management plans will be developed to sustain community demonstration farms, community conservation areas and manually drilled boreholes. This leadership development process will culminate in developing a long term sustainable development plan aimed at enhancing local livelihoods, sustaining ecosystem services for current and future generations and promoting comanagement with local leaders who will increasingly step into management roles.

7. Develop a regional change network to amplify local success and to take advantage of potential windows of opportunity.

LDCN will work with the local community to extend and amplify generative project outcomes by developing training manuals and extension guides based on the social learning outcomes from project activities. These manuals will help guide and support the ongoing maintenance of project activities and interventions as well as any future regional expansion. To help disseminate important insights and learning, this information will be open-source and published on LDCN's website as well as through peer reviewed academic journal articles. Finally, the community sustainable development plan will be communicated to local and regional stakeholders to build support and resources for ongoing maintenance and expansion of activities.

6.4. Project activities timeline

The proposed project is designed to take place over five years (see Table 9: Project activity timeline). Year one is primarily focused on collecting essential baseline data, setting thresholds for development, updating community terms of engagement and refining the project design through feedback and deliberations with the community and community leaders. By the end of year one we will initiate our capacity building activities in the community of Ndeja and subsequently expand to the communities of Nguinea and Mazongorro in year two and beyond. From this initial point of departure, the project is then designed around two primary stages, a capacity building stage and a capability build stage. As beneficiaries and community members increasingly build their individual and collective capacity through vocational training and through implementing community WEF nexus projects, they will transition into the capability building stages. Capacity building activities will be primarily concentrated in years two through four, and capability building activities will be primarily concentrated in years three to five. Participatory monitoring and evaluation will take place throughout the capacity and the capability building stages with a midway report prepared in year three. Based on project outcomes, by the end of the project in year five, a final report that includes a long term sustainability plan will be prepared. For a detailed year by year project narrative please refer to Appendix A Project Narrative. This narrative goes into a detailed description and sequencing of each of the activities including the intentions, anticipated outputs, locations, beneficiaries and participants.

Table 9: Project activity timeline

ACTIVITY	STAGE	Year 1			Year 2			Year 3			Year 4			Year 5		
		Ndeja	Nguinea	Mazongorro	Ndeja	Nguinea	Mazongorro	Ndeja	Nguinea	Mazongorro	Ndeja	Nguinea	Mazongorro	Ndeja	Nguinea	Mazongorro
Community consultation																
Community mapping	Project Design	x				x	x									
Project design community feedback		x				x	x									
Ongoing participatory monitoring and evaluation	Monitoring & Evaluation				x	x	x	x	x	x	x	x	x	x	x	x
Baseline data collection																
Ecological impact assessment	Monitoring & Evaluation	x	x	x										x	x	x
Multidimensional poverty survey		x	x	x										x	x	x
Manual borehole drilling																
Manual borehole drilling training	Capacity Building	x	x	x												
Community drilling	Capability Building				x	x	x	x	x	x	x	x	x			
Continued learning					x	x	x	x	x	x	x	x	x			
Organisational development					x	x	x	x	x	x	x	x	x			
Agroecology livelihood training																
Establish livelihood training gardens	Capacity Building	x				x	x									
Vocational training programme					x			x	x	x	x	x	x	TBD		
Local school feeding scheme					x			x	x	x	x	x	x	TBD		
Agroecology youth activist & education programme																
Agroecology training for local schools	Capacity Building	x				x	x									
Build school tree nursery		x				x	x									
Youth conservation activities & tree planting					x			x	x	x	x	x	x	x	x	x
Extension services																
Agroecology livelihood extension	Capability Building							x			x	x	x	x	x	x
Agroforestry outreach programme								x			x	x	x	x	x	x
Market development											x	x	x	x	x	x
Leadership development, knowledge sharing & network building																
Agroecology school coordinator meetings	Capability Building							x	x	x	x	x	x	x	x	x
Agroecology peer mentor programme								x			x	x	x	TBD		
Horizontal integration of women farmers														x	x	x
Local sustainable development council								x	x	x	x	x	x	x	x	x
Develop community training manuals														x	x	x

Source: Author's Own

6.5. Description of Activities

6.5.1. Introduction

LDCN's project activities can be broadly grouped into seven main categories:

1. Community consultation;
2. Baseline data collection;
3. Manual borehole drilling;
4. Agroecology livelihood training;
5. Agroecology youth activist and educational programmes;
6. Community extension services; and
7. Leadership development, knowledge sharing and network building.

Within each of these categories there are a number of more focused activities that will take place in order to achieve the capacity building objectives and capability building outcomes. The activities are designed to build on each other such that the outputs of each individual activity contribute to the larger goals and objectives of the project proposal. The remainder of this chapter will briefly introduce each of these activities.

For a more comprehensive year by year project narrative please refer to Appendix A: Project Narrative. This narrative provides a detailed description of how the proposed activities are sequenced and unfold throughout the project proposal. The project narrative also describes the intentions, goals, anticipated outputs, locations, beneficiaries and participants of each activity and how they fit into the larger vision of the project.

6.5.2. Community consultation

LDCN will engage in an extensive and ongoing community consultation process that spans the duration of the project. As much of the design of the project is a result of previous feedback from the community, the focus of the community consultation process will be to build off of past activities and interventions and to enhance and refine the project implementation strategy through community feedback and reflection. The community consultation process will consist of three primary activities:

1. Project design feedback (years 1 & 2);
2. Community mapping (years 1 & 2); and
3. Ongoing participatory monitoring and evaluation (years 2 to 5).

The project design feedback will take place prior to the implementation of direct project interventions. It will help inform and improve our initial implementation strategy and establish a starting point for project activities. The community mapping will be a participatory workshop in which LDCN will work with community leaders to identify key community livelihood assets and to demarcate the locations for project interventions (including

sites for drilling boreholes, demonstration farm sites and a community conservation area). Finally, the ongoing participatory monitoring and evaluation will consist of an annual community reflection process as well as a more programme specific reflection with direct project participants.

Collectively, the goal of the community consultation process is to build trust and rapport with the community through open and transparent processes that foster critical reflection, share successes and challenges of project activities, address concerns that may arise and maintain direct two way communication with the community and project participants.

6.5.3. Baseline data collection

The baseline data collection is focused on collecting important socio-ecological data and is designed to track progress on key project indicators and to ensure the project is operating within broader regional ecological thresholds. This will be achieved through two main activities:

1. Implementing an ecological impact assessment; and
2. Facilitating a multidimensional poverty survey.

Whereas the ecological impact assessment will focus on collecting key WEF nexus data, the multidimensional poverty survey will identify the relative intensity and types of poverty individual households and the broader community face. To complete both assessments, LDCN will partner and work with graduate students and professional consultants. LDCN project leadership will help guide and facilitate the assessments and data collection whereas the graduate students and professional consultants will provide technical insight and independent verification. In order to track progress and evaluate the impact of project activities, these assessments will take place in year 1 and in year 5. The EIA and MDP surveys are well recognised external benchmarks and thus carry important weight for justifying LDCN's approach to external stakeholders.

Beyond this more external justification and objective data collection process, the intention of the baseline data collection process is also to validate and complement the community consultation process through a multiple evidence based approach. Using a multiple evidence based approach not only helps surface synergies and insights into different forms of knowledge production, but it also serves as a fail-safe by shedding light on potential incongruencies in the monitoring and evaluation of project activities. The results from baseline data collection will be used to triangulate findings from the community mapping exercise and the ongoing community consultation process to support and/or refine the project design. In doing so, the goal is to coproduce a robust and locally relevant set of baseline data to help guide project activities.

6.5.4. Manual borehole drilling

The goal of the manual borehole drilling activities is to provide access to clean water for at least 75 percent of the target population (10,000 people) by drilling at least one borehole for every 200 community members or 25 families. Manual borehole drilling is an innovative drilling technique that significantly reduces the cost and logistical difficulty of drilling boreholes in less accessible and rural areas in the developing world. It uses machines, equipment and tools that can be found, or fabricated locally, and the drilling process does not require any previous training or experience. Manual borehole drilling activities will take place from year 1 to year 4 and will consist of four primary activities:

1. Manual borehole drilling training (year 1);
2. Community drilling programme (years 2 to 4);
3. Continued education (years 2 to 4); and
4. Organisational development.

The manual borehole drilling training will take place in year one and is a vocational training programme aimed at capacitating 20 to 30 community members, or two complete drill teams, in manual borehole drilling. The initial vocational training will take about one month and will include the practical experience of drilling at least ten boreholes. An external trainer will facilitate the training after which LDCN will provide support to the local drill teams as part of an ongoing community drilling programme from year 2 to year 4. In addition to the manual borehole drilling vocational training, LDCN will provide opportunities for continuing education and skill development related to access to water and sanitation. Potential future workshops and trainings will include:

- Methods to determine specific locations of where to drill boreholes;
- Pump fabrication and maintenance;
- Rain water collection systems and storage tanks (including ferrocement building techniques);
- Ground water recharge systems; and
- Building of improved latrines.

These trainings are meant to complement previous trainings and further equip the drill team with a diversity of practical and marketable skills.

Finally, LDCN will provide organisational support to the drill teams by hosting quarterly workshops and monthly meetings over the three year duration of the borehole drilling campaign (years 2-4). Initially, this organisational support will focus on providing logistical and planning support including, but not limited to, technical support, tracking inventory, caring for and storing equipment, developing roles and responsibilities within the drill team and planning and scheduling activities. As the drill team progresses and develops greater autonomy, LDCN will shift its support to:

- Developing an organisational structure and formally registering the drill teams with the appropriate local and provincial authorities;
- Setting up financial systems including bank accounts, budgeting and record keeping; and
- Developing a business model and marketing campaign.

Ultimately, the drill team should progressively develop towards an entity that has the capability to function independently as well as the agency to negotiate and collaborate with LDCN on future drilling projects and contracts.

6.5.5. Agroecology livelihood training

LDCN's agroecology livelihood training activities are focused on providing vocational training to 75-100 women across three communities. The agroecology livelihood training programme will be a 12 month vocational programme for a cohort of ten to 15 local women. The training will take place on a livelihood training farm located in each of the three target communities. The training farms will also serve as a demonstration farm and as a space for meaningful engagement and interaction with the broader community. The training programme has three core objectives:

- To demonstrate and teach agroecology farming techniques through monthly workshops;
- To grow food for the school feeding scheme; and
- To evaluate the livelihood potential of agroecological farming practices through demonstration and collaborative data collection with programme participants and beneficiaries.

LDCN will provide the inputs for the livelihood demonstration farms and LDCN's agroecology extension officer will manage and coordinate activities with the local women participants. Women participants will earn a small stipend for their work on the farm as well as targeted incentives based on participation and evaluation of activities. Upon completion of the 12 month training programme, the women will become eligible for continued support through an agroecology livelihood extension programme and an agroforestry outreach programme (see section 6.5.7 Extension services).

6.5.6. Agroecology youth activist and education programme

The goal of the agroecology activist and education programme is to develop youth custodians for community conservation who will have the skills and knowledge to contribute to the long term and regenerative process of rehabilitating local ecosystems and promoting local biodiversity. The agroecology youth activist programme will take place from throughout the duration of the five year project and will focus on involving school children in the conservation and ecological development of the community. The agroecology activist programme will focus on fun and practical monthly activities that help to build the natural resource base of the local community.

The core activity will be to raise tree seedlings in a school nursery and plant them in the community conservation spaces. Additional activities may include:

- Disseminating information and building awareness about local conservation issues;
- Participating in a trash pick-up and recycling programme;
- Introducing STEM (Science, Technology, Engineering, Mathematics) related education programmes; and
- Contributing to school food production.

In order to facilitate this programme, LDCN will host an intensive six day training for the school teachers and the school director of each of the three schools in broader Ndeja community. The training will have a number of key curriculum goals including:

- Introducing the concept and principles of agroecology and connecting them to important concepts surrounding climate change, ecology and the sustainability;
- Exploring how the concept of agroecology is relevant to the local community and bioregion;
- Participating in practical exercises and demonstrations related to agroecology;
- Brainstorming and developing possible agroecology activities for school children; and
- Developing a job description and evaluation criteria for a school agroecology coordinator.

At the end of the training, the teacher participants will nominate and vote for an agroecology coordinator based on the job description and evaluation criteria developed during the training programme. The school agroecology coordinator will work with LDCN to help organise, mobilise and coordinate the agroecology youth activist programme for local children. This position will have a number of built in incentives and perks based on a performance evaluation by LDCN, the other teachers and the local school director. It is also expected that the agroecology school coordinator will involve youth in supporting food growing activities that support the local school feeding scheme.

6.5.7. Extension services

LDCN's community extension services will build on the livelihood agroecology training programme to support, extend and amplify the agroecology capacity of the 75-100 women graduates for generative community outcomes. Upon completion of the 12 month training programme, the women will become eligible for continued support through three community extension programmes:

1. An agroecology livelihood extension service (year 3 to 5);
2. An agroforestry community outreach programme (year 3 to 5); and
3. A market development initiative (year 4 to 5).

The agroecology livelihood extension service will focus on providing design support, technical services and inputs for women who have successfully completed the agroecology livelihood training programme and who are interested, committed and motivated to implement activities on their own farms and in their own homes. As part of their final reflection and evaluation of the livelihood training programme, women graduates will identify if, where and how they would like to move forward with the knowledge and skills they developed from the agroecology training programme. LDCN's agroecology extension officer will then support these women with different inputs and extension services to help them reach their goals. Although the agroecology extension services will primarily be focused on providing physical, natural and human capital, the long-term goal of the extension programme is to also provide opportunities to increase access to financial and social capital, thereby enhancing access to all five forms of livelihood capital.

In exchange for the above extension services, the women agroecology livelihood graduates will contribute to a community agroforestry outreach programme. The programme is designed to provide local families the opportunity to access home scale solar panel systems and improved firewood cooking stoves in exchange for planting trees on their land. Women graduates will care for neighbourhood tree nurseries in which tree seedlings will be used to support neighbouring families in an agroforestry tree planting initiative. The basic design of the tree planting will be taught during the agroecology livelihood training programme and follows an agroforestry design in which a combination of indigenous hardwoods, improved fruit and nut trees and fast-growing leguminous trees are planted along the perimeter of a farm. Whereas the fast-growing leguminous trees will help soil fertility and provide a sustainable source of firewood, the fruit and nut trees will contribute to food security and the indigenous hardwoods will provide a potential long-term income. As part of the outreach programme, the goal is also to build a firewood saving rocket stove with each participating family. Families who participate in the programme, successfully plant trees on their land and build a firewood saving stove will subsequently receive a home scale solar panel system to enhance household access to energy. The programme is designed to provide neighbourhood level accountability and oversight to help ensure that the women graduates care for and provide the tree seedlings for participating neighbouring families.

Finally, in year four, LDCN will initiate a market development programme focused on providing value added services to women graduates and the broader community. This will include providing weekly transport services to local markets as well as piloting and demonstrating innovative methods, practices and technologies for processing and storing local agricultural production including:

- Improved solar dryers;
- Improved grain storage and small-scale silos;
- Small scale cold storage; and
- Oil press for processing and making oil from local agriculture production.

Initially, the focus of the market development programme will be prototyping and testing different solutions, analysing their economic potential and creating a viable product business plan. Based on the results of this collaborative process, we will explore opportunities to expand these pilot demonstrations into larger livelihood development programmes in year five.

6.5.8. Leadership development, knowledge sharing & network building

The culmination of LDCNs project proposal is to strengthen the connective tissue, adaptive capacity and collaborative capability of the broader community of Ndeja. As such, as the project progresses, activities will increasingly focus on developing local leadership and the horizontal and vertical networks of community members, project participants and community leaders. Starting in year 3 and continuing through the end of the proposed project in year 5, this will entail five principal activities:

1. Facilitating meetings between the three agroecology school coordinators;
2. Developing an agroecology peer mentor programme;
3. Fostering the horizontal integration of women farmers;
4. Creating community training manuals; and
5. Establishing a local sustainable development council.

First, introducing the youth agroecology activists programme into the three local schools creates an opportunity to link the schools and develop a broader collective youth agroecology action network. Rather than creating isolated islands of school tree planting initiatives, by linking the school agroecology coordinators, LDCN will lay the foundation for potential catalytic collaboration of larger scale, regenerative agroecology initiatives. To do this, LDCN will host a quarterly meeting with the school agroecology coordinators to collectively discuss opportunities, plan initiatives and troubleshoot challenges. As part of these quarterly meetings and school to school collaboration, LDCN will reserve a portion of the agroecology youth activists budget as a collective action fund to be co-managed with all three school agroecology coordinators for collaborative projects. Year five will be the final officially funded year of the project and thus discussions surrounding this fund will also be increasingly oriented towards the sustainability and long term planning. Ultimately, the goal of these quarterly meetings is to empower the agroecology school coordinators not only to increasingly see themselves as leaders but also to imagine ways they can amplify the impact of their efforts during and after the funding period.

Second, as part of the agroecology livelihood training programme, a cohort of 10 to 15 women participants will train and work on a local livelihood training farm for 12 months. In order to facilitate the transition from one cohort to the next, former women participants will serve as peer mentors during a six month transition period in order to help sensitise and integrate the next cohort of participants during the initial stages of the programme. The ability to articulate and pass on information and knowledge can help aid in the transition from the capacity building stage to the capability building stage. Through the peer mentorship programme women graduates will

have an opportunity to practice this process and find their voice by communicating with their peers about what and how they learned during their time in the training programme. This process is also beneficial in that former women participants are better suited to teach material in a relevant and relatable way for current participants. Finally, as part of this peer mentorship programme, LDCN will also plan and schedule a variety of different field trips to learn and experience how different agroecology techniques and methods can be used and adapted, in variety of ways, to achieve a diversity of goals. Ultimately, the goal is to foster a peer to peer social learning process that inspires ideas, opens up new possibilities and integrates people across the broader region.

Third, through the duration of the project proposal, LDCN will cultivate the social relationships and human capital needed to foster a horizontal integration of women farmers. This process will culminate in year five by establishing a monthly women farmers forum focused on creating a safe space for women to come together. Initially, this will focus on leveraging LDCN's market development activities for the benefit of the collective group. However, over time the form and function of the women farmers forum and broader horizontal integration process will depend on the women themselves. Ultimately, the goal of this integration process is to develop a cooperative and supportive network to share knowledge and experiences, leverage continued support and resources, share the burden of common expenses and advocate for the role and rights of women farmers.

Fourth, in order to facilitate widespread access and disseminate information about the project beyond the immediate district, we will develop a set of training manuals and an open source webpage. The goal of the training manuals and the website is to not only to spread awareness about the project and to catalyse a regional expansion process but also to tell the story of the project and the diversity of participants who contributed to it. The manual will be oriented towards other development organisations, extension officers and practitioners and will be coproduced with the local community and project participants.

Last, but certainly not least, LDCN will formalise its community coordination and consultation by developing a local development council. The formation of this leadership council will be accompanied by a leadership development programme that will take place through quarterly meetings. The goals of this leadership development programme are to:

- Develop a consistent and cohesive approach in providing oversight and management of project interventions;
- Reflect on and track progress on programme and project outcomes;
- Help disseminate important information to community members;
- Open an ongoing line of communication and dialogue process surrounding collaborative efforts between LDCN and the community;
- Engage in conversations about long-term roles and responsibilities for managing community development and the needs and opportunities associated with these roles and responsibilities;

- Provide transparency and inclusion in the design, budget and implementation of activities.

The core participants and audience for this leadership training are the “secretarios dos barrios”, or the locally recognised government liaisons, and other local community members and programme participants that emerge as leaders during the first two years of project implementation. As part of this process, local leaders will actively accompany and take part in the monitoring and evaluation process of each of the project’s programmes. At quarterly development council meetings, we will then reflect on the shared experience and responsibility for monitoring and evaluation of activities, and subsequently seek to identify both the challenges and the opportunities that arise within the process. These meetings will play an increasingly important role in deliberating and negotiating the pathways for sustaining or adapting community initiatives after the official project closure in year 5. As such, one of the key objectives of this discussion is to bring to the surface the necessary minimum conditions to meet the needs of local leaders and to ensure their consistent, effective and transparent participation. The long term goal of this process is not simply to pass on full responsibility to oversee and manage development to community leaders by the end of the project. Rather it is to lay the foundation for a broader community governance structure to emerge, one in which community leaders have the capacity and the capability to collaborate and comanage activities for the wellbeing of the community and the local ecosystem.

7. Chapter 7 – Project proposal monitoring and evaluation (LFM horizontal logic)

7.1. Introduction – The goals of LDCN’s M&E framework

LDCN’s monitoring and evaluation (M&E) strategy has four primary goals:

1. To develop indicators to track the socio-ecological outcomes and effects of LDCN’s activities;
2. To objectively verify those outcomes and effects;
3. To ensure project activities fall within key ecological thresholds;
4. To integrate a set of locally relevant design principles to foster a collaborative and adaptive form of M&E.

To achieve these goals LDCN has developed a context specific set of indicators to track progress towards the proposed capacity building objectives and capability outputs. These indicators will be communicated and refined with the local community during out initial community consultation process in year one.

7.2. Indicators – Measuring the socio-ecological outcomes and effects (goal 1)

7.2.1. Introduction

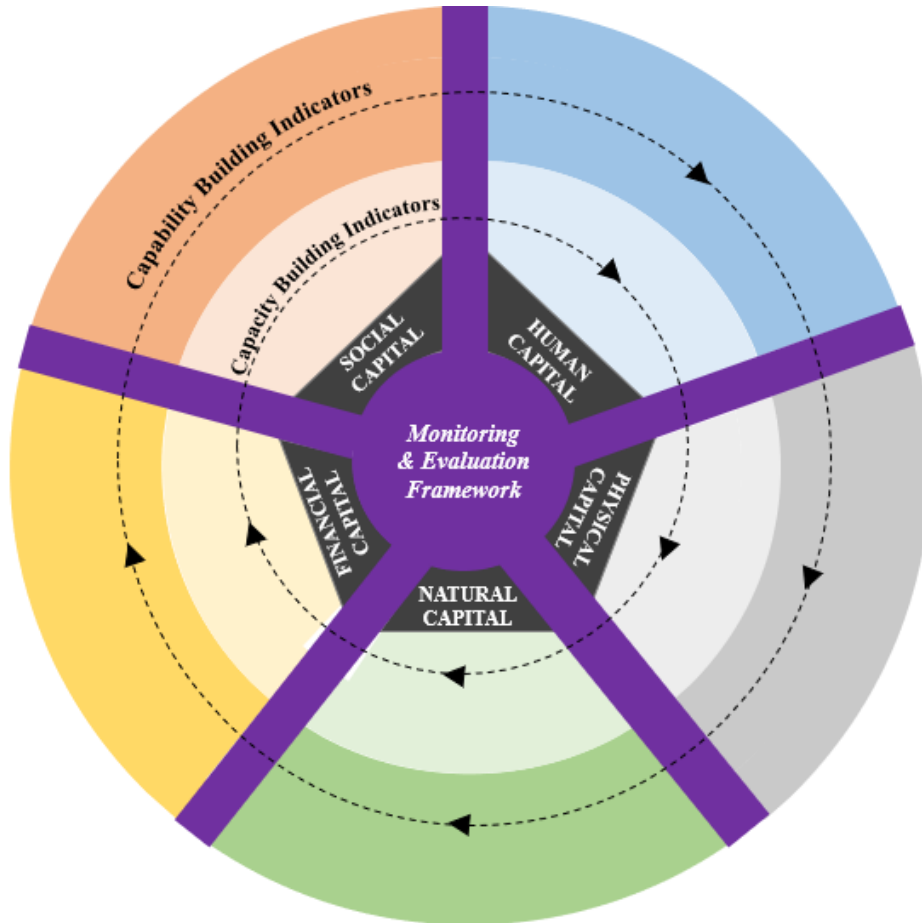
To achieve the first goal of tracking the socio-ecological impacts of LDCN’s activities, the M&E strategy is designed to be context specific to the local setting and attuned to measure the specific objectives and outputs of each of the two stages of the project proposal, the capacity building and capability building stages. The broad goal of the first stage, the capacity building stage, is to enhance access to key livelihood assets in the WEF nexus. The sustainable livelihoods approach broadly organises these livelihood assets into five types of capital:

1. Human capital – health, education, knowledge and skills;
2. Physical capital – infrastructure, tools, equipment and provision of basic services;
3. Natural capital – land, water, building materials, soil fertility and other ecosystem services;
4. Financial capital – income, savings, credit and other sources of money;
5. Social capital – formal and informal support networks and connections (Donohue & Biggs 2015).

Although access to each these forms of capital is necessary, in and of themselves they are not necessarily sufficient to enhance livelihoods and achieve improved outcomes. The goal of the second stage of the project, the capability building stage, is to build the agency, networks and resources needed to utilise improved access to these forms of capital. Through a suite of extension services, leadership development initiatives, networking building activities and social learning processes, LDCN will support community members to deploy their individual and collective assets for improved livelihood outcomes. As such, the indicators for both stages can loosely be correlated to the access and successful deployment of these five forms of capital. As such, LDCN’s

indicators are organised and designed by stage and by type of livelihood capital within the M&E framework (see Figure 10: M&E Framework: Integrating the five forms of livelihood capital and project indicators).

Figure 10: M&E Framework: Integrating the five forms of livelihood capital and project indicators



Source: Author's own

7.2.2. Capacity Building Indicators

Capacity building activities will primarily be driven by LDCN project leadership and will start with pilot vocational training initiatives aimed at building the physical capital needed to address immediate community needs. Indicators are primarily focused around improving education and vocational training (human capital) and developing the key physical infrastructure (physical capital) and relationships (social capital) needed for project expansion.

Indicators for **human capital** include:

- 20+ community members are trained in manual borehole drilling
- 75-100 women trained in agroecology food production

- 75-100 women trained in agroforestry and tree seedling production; and,
- 350 youth participate in a school based agroecology activist education programme.

Indicators for **physical capital** include:

- Local schools have access to clean water, improved sanitation and solar energy;
- Community tree nurseries are built;
- Livelihood training farms are equipped with necessary inputs for food production; and,
- Drill teams have access to equipment and tools for manual borehole drilling.

Indicators for **natural capital** include:

- School forest and community conservation spaces are identified and established; and,
- Key ecological thresholds are agreed upon with the community.

Indicators for **social capital** include:

- Outstanding youth leaders nominated as local environmental custodians;
- Local development advisory council is established;
- Community asset map created with community; and,
- Baseline data collected and discussed with community;

There are not indicators for **financial capital** in the capacity building stage as activities are more focused on building the foundation for socio-economic upliftment. Access to financial capital will be increasingly integrated into capability building activities and indicators.

7.2.3. Capability Building Indicators

The goal of the capability stage is to increasingly manage and deploy community livelihood assets in a diversity of ways that are adapted to address a diversity of local needs. At a household level, capability building activities are focused on improving food security (human capital), access to clean water (physical capital) and access to improved energy sources (physical capital). Activities will focus primarily on working with local women on building a social support system (social capital) to empower women and enhance gender equality. At a community level, capability building activities are focused on working with the local community development council to develop the networks (social capital) and planning skills (human capital) to help manage community conservation spaces and demonstration sites (natural capital). Finally, to foster a local innovation niche and improve access to income generating activities (financial capital), capability building activities will focus on fostering viable economic pathways to develop and improve on the production, storage,

processing and transport of local agriculture production. The capability building indicators are dependent on outcomes of the capacity building activities and will therefore need to be recalibrated as the project progresses. As such, the final capability building indicators will be refined at the end of year three and presented in greater detail in the midway evaluation that will report on the initial outcomes, success, challenges and opportunities that emerge from implementation of initial capacity building activities.

Indicators for **human capital** include:

- Household dietary diversity is improved;
- Acute food shortages are decreased;
- Local drill team is legally recognised by the proper authorities;
- Transition plans for post project sustainability are created for the agroecology livelihood training programme and the agroecology youth activist programme; and,
- Training manuals are completed with community members.

Indicators for **physical capital** include:

- 75 percent of households (10,000 people) are within 1km or 30 minute round trip walk to clean water;
- Household access to solar lighting is increased;
- The distance to and quantity of firewood needed for household cooking is decreased; and,
- Innovative income generating activities for the production, storage and processing of local agroecological outputs are identified and demonstrated on livelihood training farms.

Indicators for **natural capital** include:

- School forest and community conservation spaces are identified and established with community;
- Soil quality and soil biology on livelihood training farms is improved;
- Biodiversity is improved in community conservation spaces and on livelihood training farms;
- Land cover loss is stabilised or improved; and,
- Ecological thresholds are respected.

Indicators for **social capital** include:

- Women's participation and group membership in formal and informal associations, self help groups and/or entrepreneurial groups has increased;
- Women make up 50 percent of local development advisory council;
- Women actively take part in decision making and governance surrounding community commons;
- 75 percent of boreholes are maintained and operational at any given moment;

- Local development council participates in yearly monitoring and evaluation;
- A long term sustainable development plan is created and agreed upon with the community;
- Results are disseminated through academic publications and open source mechanisms; and,
- Vertical linkages and partnerships are developed with regional stakeholders.

Indicators for **financial capital** include:

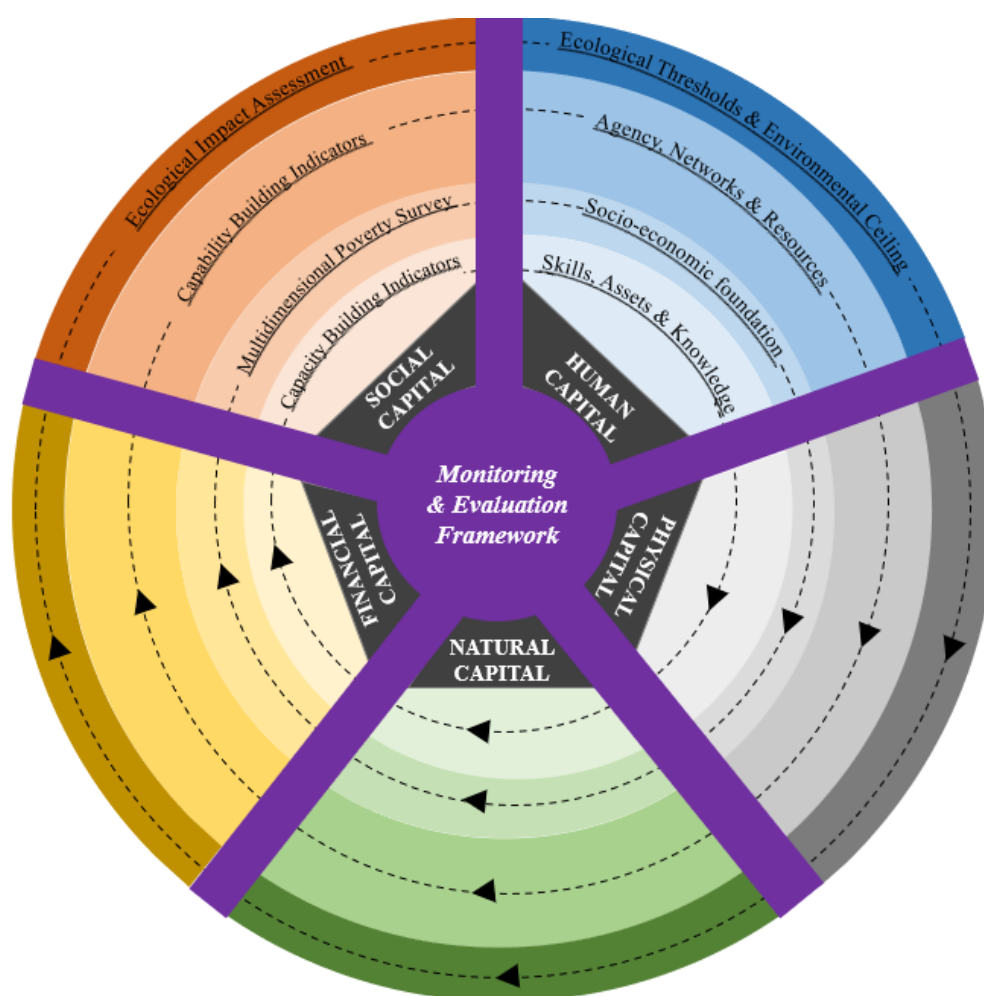
- Women have increased access, credit, ownership and decision making power in relation to household agriculture assets and production decisions;
- Transport costs have decreased and access to local markets have increased;
- A minimum viable business plan is developed for key incoming generating activities; and,
- Access to credit for income generating activities has improved.

7.3. Objective means of verification – corroborating the outcomes and effects (goals 2 & 3)

7.3.1. Introduction

In order to verify socio-ecological outcomes and to ensure activities fall within key regional ecological thresholds, LDCN will collaborate with external consultants and graduate students to conduct an ecological impact assessment and a multidimensional poverty survey for the immediate region surrounding the target area of Ndeja, Mozambique. These more technical and quantifiable data collection techniques will be implemented in year one to collect baseline data and, again in year five, to identify if, where and how progress has been achieved.

The goal of integrating these two data collection techniques builds off Raworth's (2012) doughnut framework for developing a safe and just operating space for sustainable development. According to Raworth (2012), this safe and just operating space falls between the environmental ceiling, or ecological carry capacity, and the socio-economic foundation of basic human needs. If operating in this safe and just operating space, sustainable development interventions can contribute to policy that fosters environmental sustainability while also addressing critical human deprivations. In the context of the project proposal, the ecological impact assessment (EIA) will help establish the environmental ceiling, or the local and regional ecological thresholds that cannot be passed, while the multidimensional poverty (MDP) survey will help determine the socio-economic floor, or the minimum deprivations that need be overcome for meaningful development (see Figure 11: M&E Framework: Integrating the EIA and MDP survey).

Figure 11: M&E Framework: Integrating the EIA and MDP survey

Source: Author's own

7.3.2. Multidimensional Poverty Survey

The multidimensional poverty survey will focus on collecting multidimensional poverty statistics through a household survey across the different neighbourhoods in the broader community of Ndeja. The choice to use a multidimensional poverty index is that it provides a more granular and nuanced understanding of the intensity and type of poverty individual households face. A traditional multidimensional poverty survey incorporates the analysis of ten variables across three dimensions (health, education and living standards) to assess the breadth and depth of poverty (Victor, Blevins, Green, Ndatimana, González-Calvo, et al. 2014; Donohue & Biggs 2015). This multidimensional poverty index is particularly useful in that it offers a comparable approach within and across local, national, regional and transnational scales. It therefore can contribute to identifying regional and local differences in the type and severity of challenges households and communities face thereby enhancing planning efforts and development interventions.

Table 10: Multidimensional poverty index used in Mozambique

Dimension	Indicator	Deprivation cut-off (poverty line)	Weight	Deprivation
Education				
	Years of Schooling	Literacy score<16 and numeracy score<5	1/6	Low literacy
	Child Enrollment	Child in household="Yes"+age ">6" or age "<15"+attending school = "No"	1/6	School-aged child is not attending school
Health				
	Child Mortality	Fever last 30 d = "Yes", Diarrhea last 30 d = "Yes" or Difficulty breathing last 30 d = "Yes"	1/6	Child with acute illness
	Nutrition	Household dietary diversity score<4	1/12	Low dietary diversity
		Lack of food episode during last month = "Yes"	1/12	Lack of food episode during last month
Standard of living				
	Electricity	Electricity = "No"	1/18	No electricity
	Water	Water source is river = "True", OR time to water = ">30 min", AND mode of transport to water = "On foot"	1/18	Water source is river or more than 30 minutes away on foot
	Sanitation	Household uses latrine = "No"	1/18	No use of latrine
	Flooring	Roof type = "grass/cane/leaves/straw"	1/18	Poor housing material (grass roof)
	Cooking Fuel	Type of fuel household uses = "Wood"	1/18	Poor cooking fuel (wood)
	Assets	Sum of radio = "Yes"+television = "Yes"+bicycle = "Yes" = <1	1/18	Low assets (no radio, television, bike)

Source: Victor et al. (2014)

Building off this more standard multidimensional poverty index, a number of authors and development organisations have developed variations that are attuned to measure a diversity of more locally relevant dimensions and deprivations. Of particular interest to this project proposal are the Women's Empowerment in Agriculture Index (WEAI) developed by Alkire, Meinzen-Dick, Peterman, Quisumbing, Seymour and Vaz (2013), and the Multidimensional Livelihoods Index (MLI) developed by Donohue and Biggs (2015).

The WEAI is based around five dimensions of empowerment in agriculture including production, resources, income, leadership and time. Each of these dimensions is accompanied by weighted indicators that help to quantify and measure the relative level of empowerment or disempowerment a woman possesses. This form of analysis is particularly useful to verify project outcomes, as one of the key objectives of the capability building stage is to empower and build the agency of local women through agroecology training and extension services.

Table 11: Women's Empowerment in Agriculture Index

Domain	Indicator	Weight
Production	Input in productive decisions	1/10
	Autonomy in production	1/10
Resources	Ownership of assets	1/15
	Purchase, sale, or transfer of assets	1/15
	Access to and decisions about credit	1/15
Income	Control over use of income	1/5
Leadership	Group member	1/10
	Speaking in public	1/10
Time	Workload	1/10
	Leisure	1/10

Source: Alkire et al. (2013)

The MLI has a more explicit focus on livelihood wellbeing and utilises the sustainable livelihoods asset pentagon and its associated five forms of capital (human, physical, natural, financial and social) as the focal point and five dimensions of the index. Donohue and Biggs (2015) developed a set of 23 indicators across these five dimensions to help surface the relative deprivations in livelihood assets that households face. This approach to quantifying access to livelihood assets not only helps identify deprivations and vulnerabilities but can also highlight relative strengths and assets that households and communities possess to cope with and respond to stresses and crises. Furthermore, by disaggregating this data at more regional and local scales, more locally relevant strategies can emerge.

Due to the spatially heterogenous nature of how poverty manifests itself, a multidimensional poverty analysis allows for indicators to be adapted based on the unique problems setting of the research. As such, the multidimensional poverty survey proposed for this project will integrate key components and indicators from each of these models. Similar to the MLI, LDCN will base its MDP survey on the five forms of capital and the five dimensions of study. We will also integrate and use the WEAI to verify indicators surrounding women's empowerment (within the different livelihood dimensions). Finally, to facilitate a comparable approach to other local and regional studies, we will embed key indicators from the standard multidimensional poverty survey to help ascertain the relative magnitude of multidimensional poverty in Ndeja.

LDCN will complete its MDP survey over a 12 week period (about 90 days) in year 1 and year 5. The first week will be focused on training six to eight graduate students in data collection methods. This will be then be followed by a 10 week data collection process in which we survey 50 percent of all the households in the target area (approximately 1000 households). The final week will be used to compile the results of the survey and to discuss the results.

7.3.3. Ecological Impact Assessment

The ecological impact assessment, or environmental impact assessment (EIA), will focus on collecting and analysing more technical ecological baseline data to help refine the project design and ensure project activities meet and fall within key environmental thresholds. The EIA that will be developed and used in the context of this project will integrate a WEF nexus lens to understand the synergies and trade-offs of different development activities to help secure access to water, energy and food. Building off this WEF nexus lens, the project's EIA will investigate four key areas:

1. Hydrology
2. Biodiversity
3. Land Use/Land Cover (GIS)
4. Soil Conditions

Each of these areas has key linkages to the WEF nexus. A hydrological analysis as part of the EIA will help identify opportunities and challenges for management of community water resources. Of particular interest is the potential of ground water resources and seasonal rivers for household and community level irrigation projects. Understanding upstream water uses and flows is also important to understanding the hydrological capacity of the local community. Finally, with the project's focus on manual borehole drilling, identifying the key risks and threats associated with ground water extraction, including potential contamination will be essential.

Biodiversity is a key indicator for ecosystem health, which is essential in providing and sustaining the availability of key ecosystem services for local communities. In the context of the project proposal, surveying and understanding the richness of species diversity and their relative evenness across the local bioregion is critical for quantifying and understanding habitat loss and the vulnerability of local flora and fauna. In the context of the project proposal, the identification and quantification of the richness and evenness of medicinal plants and other forestry species/products that hold important traditional uses are of particular interest. These plants and species and their uses represent important traditional knowledge and offer the opportunity to enhance local livelihoods.

Connected with analysing the richness and evenness of biodiversity are studies related to land cover and land use. Mozambique has experienced considerable deforestation and land cover loss due to a combination of unsustainable local practices (such as cutting firewood and making charcoal) as well as corrupt and/or environmentally detrimental practices by multinationals (such as large scale deforestation of important indigenous hardwoods). The loss of land cover and unsustainable land use has a number of potentially negative socio-ecological impacts that can subsequently impact access to local ecosystem services at a community and

regional level. GIS mapping and aerial drone footage can be used to delineate land use and land cover and can help to identify critical natural resources and spaces to focus conservation efforts.

The final focus area of the project specific EIA is the analysis of local soil properties. This will include widespread soil testing to help identify and quantify soil erosion, loss of top soil, soil structure and soil biology. Good soil health and management plays a key role in food production and subsequently in helping to promote food security in rural African locations. Soil testing will take place in a diversity of locations throughout the target project region to track and help identify best practices of soil management.

7.4. Integrating locally relevant design principles (goal 4)

7.4.1. Introduction

LDCN's monitoring and evaluation framework has established key indicators for the capacity and capability building stage. These indicators are organised around the five forms of capital that make up the asset pentagon of the sustainable livelihoods approach. In order to objectively verify progress on these indicators, LDCN has integrated a multidimensional poverty survey and ecological impact assessment into years one and five of project implementation. By collecting and tracking this baseline data, the EIA and MDP survey will also contribute to identifying the safe and just operating space for current and future project activities, while surfacing key assets and opportunities that arise from the development process. However, to achieve the project proposal's long term goal of fostering the conditions needed for a locally relevant, ecologically sustainable and financially viable form of adaptive comanagement to emerge and contribute to flourishing futures for rural Mozambican communities, this more technocratic and top down form of monitoring and evaluating needs to be balanced and corroborated by a more participatory, reflective and community oriented monitoring and evaluation.

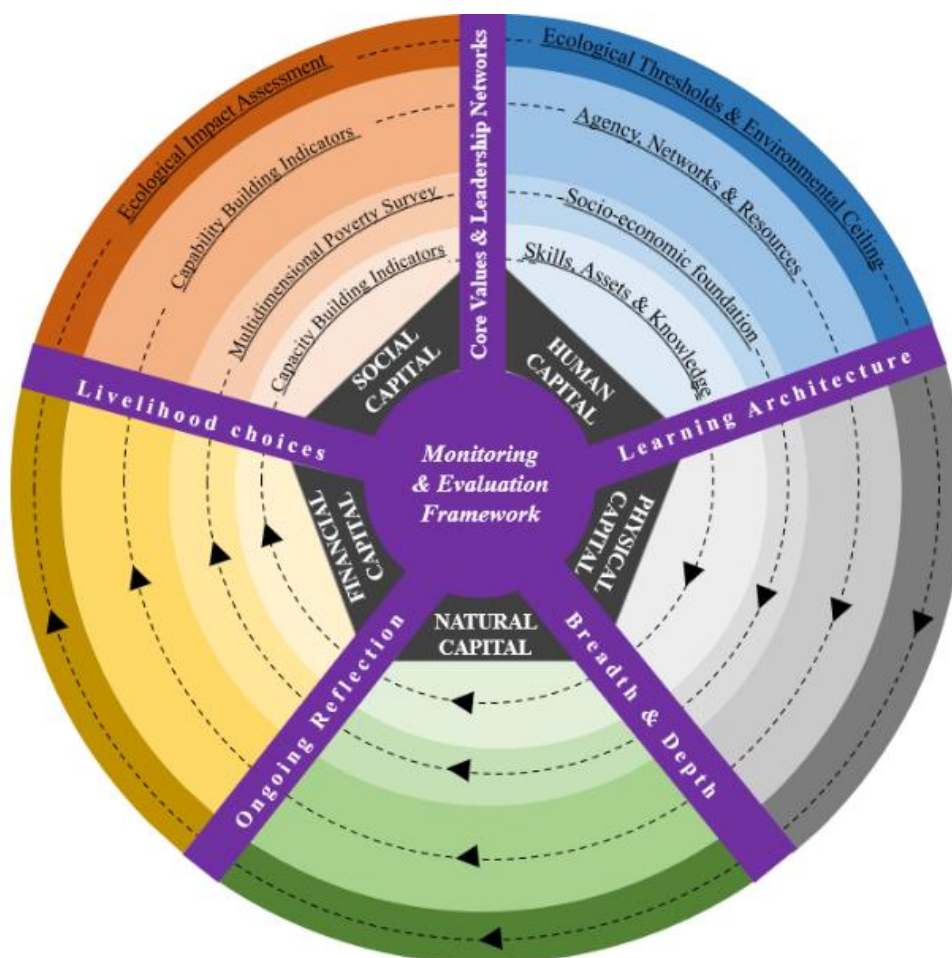
As such, the last component of LDCN's monitoring and evaluation framework is to embed a set of design principles into LDCN's M&E framework (see Figure 12: LDCN's final M&E framework). The big picture goals of the design principles are to solicit community feedback, promote social learning and surface opportunities to amplify generative project outcomes. The five design principles in LDCN's M&E framework are adapted to the local context and collectively contribute to a holistic M&E framework that integrates results oriented, technocratic, top down considerations, with community based, participatory bottom up processes. These design principles emerged through ten years of experience working with the target population, through critical reflection on the results of a community based participatory action research (CBPAR) process and an in-depth literature review focused on WEF nexus theory, the sustainable livelihood approach and adaptive comanagement. The five design principles, which also serve as guiding principles, are:

1. To start with small and locally relevant initiatives and progressively increase the *breadth and depth* of project interventions;

2. To develop a meaningful *learning architecture* that demonstrates innovation, values local knowledge, enhances inclusive participation and fosters peer to peer learning;
3. To foster *ongoing and collective reflection* on project activities and interventions;
4. To clearly define *core values* and foster *leadership networks*; and
5. To build meaningful *livelihood choices* that enhance individual and collective capabilities as well as long term economic viability.

By building off past experiences, these guiding principles provide coherence and a golden thread to connect past, current and future interventions. Each of the principles offer broad support and guidance for fostering a meaningful and locally relevant form of M&E that gives value to local perspectives, needs, values and aspirations. They also provide direction in responding to externalities, unexpected outcomes and changes in the problem setting that may arise as the project unfolds. Perhaps most importantly, though, these principles are not static or rigid pillars but rather can manifest themselves in new and adaptive ways based on the constantly shifting socio-ecological dynamics at play. As such, these principles need to be continually updated through action and critical reflection (praxis) throughout project implementation.

Figure 12: LDCN's final M&E framework (design principles are in purple)



Source: Author's own

7.4.2. Increasing breadth and depth

At the core of the project's implementation strategy is building the broader capacities of the local community in order to enhance the depth of capabilities needed to address local needs. To facilitate this process the project will develop the broad limits from within which the project will take place (the safe and just operating space) to subsequently explore a depth of possibilities for meaningful local development. The project will start with pilot focus groups designed to experiment and to refine methods and subsequently to expand outwards to increasingly reach more beneficiaries. The goal of the capacity building stage is to build the foundation to broaden LDCN's support and extend its impact to reach a greater number of beneficiaries. Women from the agroecology training will develop the skills to roll out a community agroforestry outreach programme, and production from this vocational training programme will be used to support a local school feeding scheme. Youth participants in the agroecology activists and education programme will contribute to broader community conservation efforts including a tree planting initiative. Drill teams capacitated in manual borehole drilling will contribute to expanding access to clean water through a borehole drilling campaign.

In addition to broadening and expanding the impact of activities, the foundational skills developed during the capacity building stage will also contribute to a greater depth of impacts as the scale and scope of the project expands. Extension services will be provided to women graduates to amplify their skills and improve household food security. Ongoing support to drill teams will help build the organisational and financial capability of drill team members. By connecting skill development with meaningful income generation opportunities, activities will contribute to building a local innovation niche and will foster the adaptive skills and leadership of community beneficiaries.

This focus on starting small and progressively widening the scope of activities has a more pragmatic and process oriented focus. By concentrating our initial efforts on relatively small projects we can attune our approach, foster essential trust and buy-in and build momentum through short term achievements and successes. The results of these initial activities will be crucial in establishing the credibility of the project's approach, in building the confidence of community members to participate in activities and in achieving medium and long term goals. By starting small and taking a more incremental and pragmatic approach, project participants and LDCN will collectively have the opportunity to build confidence and establish meaningful terms of engagement and operating procedures for a broader roll out of activities.

7.4.3. Developing a learning architecture

To support this breadth and depth of expansion, the project will build a locally relevant learning architecture as part of the M&E framework. This learning architecture has four key pillars:

1. To demonstrate to innovate;

2. To give value to local knowledge through a multiple evidence based approach;
3. To enhance inclusive participation through participatory monitoring and evaluation; and
4. To foster peer to peer learning and horizontal networks

At the heart of the learning architecture is to demonstrate to innovate. Asking or expecting community members to adopt new and innovative practices without first seeing and experiencing their value is unrealistic and unfair. The failure, or unsuccessful adoption, of new practices and techniques can have potentially devastating consequences for families and individuals living in settings of high poverty. Demonstrating potentially innovative practices and technology can enhance the credibility of project interventions by creating a safe to fail space to test and apply these innovative practices and technologies. By utilising these demonstration spaces as open and inclusive spaces of interaction and learning, community members can engage with and build confidence in both the efficacy of the methods and technology as well as their ability to deploy them. It also embeds a level of social accountability as community members can see and experience the impacts in tangible ways. Finally, by developing these demonstration spaces in public spaces and with community members, some of the potential hurdles and challenges for uptake can become more visible.

LDCN's learning architecture is also based on the concept of a multiple evidence based approach that gives value to local knowledge and local livelihood strategies. Community members possess a richness of socio-ecological knowledge that is essential to any local development process. In order to balance the more technocratic and top down EIA and MDP survey, LDCN will build in a number of key processes to integrate local knowledge in the planning and implementation process. Specifically, together with community leaders we will integrate an extensive community mapping exercise to enhance and refine the EIA. This community mapping exercise will be aimed at surfacing latent local knowledge and enhancing understanding of local livelihood strategies. Utilising the results of both the EIA and the community mapping exercise will contribute to identifying important conservation spaces, locations for project interventions, local livelihood practices and local management and conservation procedures. By combining local knowledge and scientific data the goal is to develop locally relevant ecological thresholds and generally acceptable operating procedures (rules and regulations).

To enhance this multiple evidence based approach, LDCN will develop a participatory monitoring and evaluation approach in which community leaders and project participants actively work with LDCN to collect, monitor and evaluate data. This form of participatory M&E is aimed at fostering a social learning process in which community members are increasingly able to identify, articulate and communicate the impact of project interventions. This participatory M&E approach will concentrate primarily on working with project participants, local leaders and a local development council to track project activities, establish meaningful community indicators, help resolve potential conflicts and develop transitions plans for activities post project funding.

The final component of LDCN's learning architecture is that of fostering peer-to-peer learning and horizontal networks. Peer-to-peer learning can contribute to a more effective social learning process in that peers are better equipped to translate knowledge in culturally compatible and relevant ways. Furthermore, by facilitating and creating spaces for community members to assume the role of mentor or teacher, traditional roles around who is capable of producing and sharing knowledge can be expanded to include community members. This in turn can help build self-esteem, communication skills and collaborative capabilities. Transferring the role of knowledge holder and teacher to community members builds responsibility and integrates peer to peer accountability.

7.4.4. Ongoing collective reflection

To complement this learning architecture, LDCN will also integrate ongoing collective and critical reflection into the M&E framework. This will be achieved through three primary mechanisms:

1. Community meetings;
2. Programme specific reflection with direct participants; and
3. LDCN's internal organisational reflection.

Whereas community meetings offer the opportunity for a broader community consultation process, for a better dissemination of results and for an improved opportunity to seek community feedback, programme specific reflection with participants offers the opportunity to dig deeper into the more social and process oriented impacts of specific interventions. Programme specific reflections will be organised as informal focus groups in which LDCN and participants will engage in collective reflection. This space for reflection will not only help guide and refine project activities but will also help acknowledge and deal with conflicts, unexpected changes and unintended consequences as they arise through the implementation process. LDCN's internal organisational reflection will focus on continually updating the problem setting, recognising and addressing inequities that may evolve during implementation, refining project principles as the project unfolds and finally fostering an awareness of potential windows of opportunity to amplify outcomes.

7.4.5. Establishing core values & leadership networks

In order to navigate the complex reality of implementing project activities, LDCN will work with the local community to establish a set of core values and terms of engagement. This will be accomplished through the community consultation process, the programme specific focus groups and working with local leaders. These values and operating procedures will be revisited and updated throughout the duration of the project. Critical to this process will be the defining of roles and expectations and ensuring accountability and transparency. This process should be sensitive to power dynamics and social inequities and should foster a safe, open and inclusive process.

In addition to establishing these core values, LDCN will also develop locally relevant community mechanisms to ensure that these values are respected and embodied in project activities. LDCN will foster and develop leadership networks and vertical linkages with key government authorities and regional stakeholders. This will be done through formal and informal mechanisms including building participation from school leaders and teachers, integrating peer-to-peer community oversight mechanisms and establishing points of contact for community members to voice concerns. At a more formal institutional level, LDCN will seek out input and feedback from regional government officials, and will increasingly foster their participation as project activities deepen and expand.

7.4.6. Fostering livelihood choices and long term economic viability

The final design principle and component of LDCN's M&E framework is that of fostering livelihood choices and long term economic viability. Fostering livelihood choices refers to creating an enabling environment for community members to increasingly act on their capacity and capability for generative socio-economic outcomes. Of particular relevance to this project is the transition from using livelihood assets as an external incentive towards using livelihood assets for meaningful personal choices. Although beneficiaries' participation in project activities may be initially motivated by increased access to livelihood assets, over time and with LDCN's support, participation should increasingly shift towards a personal choice. This shift would reflect an increase in agency and freedom to define personal and meaningful pathways towards development. Critical to this process is demonstrating and modelling opportunities to use livelihood assets in innovative ways to improve socio-economic outcomes.

In order for this process to be economically viable in the long term, just as community members are expected to become less dependent on external incentives, LDCN also needs to become increasingly less dependent on external funding to maintain core activities and outcomes. As such, a key component of the M&E framework and local community based participation is to identify innovative and entrepreneurial activities that offer the potential for income generation and socio-economic development. Although complete independence from external funding and incentives is not realistic within a five year time frame, by the end of year five, a number of viable economic trajectories and pathways for co-managing locally relevant sustainable development initiatives should be increasingly clear.

8. Chapter 8 – Conclusion

8.1. Introduction

In 2010, as an idealistic 23 year old American, I moved to the rural community of Nguinea, Mozambique (Nhamatanda District, Sofala Province) to volunteer in a Child Aid programme as a community development instructor. I had recently graduated from University of Richmond, VA, USA, and during my studies I had the opportunity to travel and interact with a variety of grassroots community development initiatives working around the world, ranging from: the “favelas” of Salvador da Bahia, Brazil; the underdeveloped periphery of Bhaktapur, Nepal; and inner city communities in Boston and Richmond, USA. During my domestic experiences as well as my international volunteer and travel abroad experiences, I developed an outlook and personal theory of change rooted in the power and potential of participatory community development. My heroes and role models were the grassroots community development workers working on the frontlines and promoting a more localised and participatory form of development that empowers communities and rehabilitates ecosystems. Following in the footsteps of the community development workers whom I had grown to admire and respect, in 2010, I moved to central Mozambique. I was young, optimistic, empowered with ideas and motivated to confront and overcome the unjust inequities of the world and to promote a more sustainable form of international development.

Over the subsequent ten years of living and working in rural Mozambique, I became acutely aware of what Hattingh (2001) called the “ideological battlefield” for sustainable development. I realised that sustainable development was as much about learning to balance contradictions and suspend certainties as it was about taking a particular stance (Mezirow 1981; Freire 1989; Brown 2004; Rodgers et al. 2013). I went from being enraged with mainstream top down development planning, to being disenfranchised with participatory bottom-up community organising. I saw the inherent inequality, patronising nature and unsustainable form of development embedded in many top down planning projects as well as the mirage of bottom up participatory development fade away due to ineffective results, elite capture and a lack of sustained motivation.

As Brown (2004:88) notes, “we do not really see through our eyes or hear through our ears but through our beliefs”. When I started the journey of this MPhil thesis, I no longer knew what I believed regarding sustainable development and as such my prism for viewing reality had become jaded and unclear. Despite the confusion and disorientation that came from this tenuous and unsteady foundation, I continued to find my firm ground in Freire’s (1989) concept of praxis, or utilising critical reflection and action as a liberating means to transcend individual and collective societal problems. From this point of departure, I utilised the transformative paradigm as a guide to engage in a radical questioning of what sustainable development actually looks like, how to assess success and what my specific role is in promoting sustainable development. This thesis, and the unfolding research journey, is a result of that radical questioning and the journey I took to rediscover my beliefs surrounding sustainable development. To conclude this thesis, I will first review each chapter of the thesis and

research process to track how we have arrived here. Then, I will review the immediate and pragmatic next steps needed to disseminate, amplify and leverage the result of this research endeavour for project implementation. Finally, I will conclude with some personal reflections on the personal learning journey and transformational process that has accompanied this thesis.

8.2. Reviewing the unfolding research journey

In order to address the breadth and depth of socio-ecological challenges our planet faces, innovative and adaptable development approaches that operationalise theory into practice are increasingly needed. By integrating theoretical insights from a diversity of literature, research findings from a community based participatory action research project and personal reflections on the lived practice of implementing sustainable development initiatives, this thesis seeks to demonstrate one such hybrid approach. The final output of this endeavour is a results based LFM project proposal that seeks to foster a locally relevant, ecologically sustainable and economically viable form of sustainable development and ecological governance for central Mozambique.

To arrive at this final output and conclusion, Chapter 1 began by situating the research in the broader context of the UN Sustainable Development Goals and the ‘perfect storm’ of socio-ecological factors that threaten the world’s ability to meet and ensure safe and sustainable access to water (SDG 6), energy (SDG 7) and food (SDG 2) (Schlör et al. 2018). Zooming in from this more global perspective, Chapter 1 continued by discussing the rationale and background for the research. Building on the critical and urgent need to provide safe and sustainable access to water, energy and food in rural Mozambique and my ten years of experience working there, I developed a set of research objectives oriented towards developing a meaningful project proposal to address these needs. To generate the project proposal, I developed and utilised a unique research design that combined a logical framework approach (LFA) and community based participatory action research (CBPAR) methodology.

Chapters 2 and 3 reviewed the key concepts and theories that contributed to developing the project proposal with a particular focus on operationalising theory into practice. Chapter 2 focused on highlighting the strengths and weaknesses of the LFA and LFM. The LFA continues to be widely used by development organisations and funding agencies due to its results based orientation, its ability to enhance accountability through monitoring and evaluation (horizontal logic) and its clarity that stems from the sequencing of the cause and effect logic of goals, objectives, outputs and activities (vertical logic). Despite these strengths, the LFA continues to be subject to criticism due to its more rigid, top down and technocratic use which fails to adequately account for the challenges of implementing projects in complex settings. As such, the LFA is limited in its ability to adapt and adjust to changing circumstances and windows of opportunity and to reflect and measure results that do not fit conveniently on a rigid and narrow cause and effect timeline. In order to overcome these challenges, I suggest that using the LFA as a flexible prototype rather than a rigid archetype can provide a planner the broad

scaffolding for developing a results based project without sacrificing the adaptability needed to adjust to changing circumstances.

Chapter 3 shifted from a review of the logical framework matrix (LFM) towards a literature review of the key theories that support and underpin the project proposal, namely the water – energy – food (WEF) nexus approach, the sustainable livelihoods approach (SLA) and adaptive comanagement (ACM). In addition to providing the theoretical grounding for the project proposal, the literature review also provided a window into the depth of collective knowledge surrounding sustainable development and the diversity of challenges and opportunities that may emerge. The WEF nexus literature helped to shed light on the value of analysing the synergies and trade-offs of different resource uses and the potential for collaborative and catalytic opportunities to emerge from this analysis. The SLA helped to illuminate the bottom up opportunities to enhance local livelihoods through analysing how resource users deploy different forms of livelihood capital as part of their livelihood strategies. Finally, ACM helped to provide a governance bridge between the SLA and WEF nexus through a combination of collaborative governance strategies and locally adapted social learning processes. When integrated and viewed collectively, these three theories offer an adaptable, multidimensional, hybrid sustainable development framework equipped to cope with the diversity of wicked challenges we face as a planet.

Building on this theoretical foundation, Chapter 4 shifts to the lived reality of translating theory into practice. Utilising the LFA as a flexible prototype, I integrated key insights and tools from CBPAR and transdisciplinary research (TDR) to develop a unique research design and project planning design flower to help guide the research process. Due to the impact of Cyclone Idai, I was forced to adapt my research objectives and methods to deal with the humanitarian crisis that followed. While the CBPAR literature helped me to design my original methods for data collection, TDR helped me to reimagine and apply these methods in an unfolding research process. Utilising community engagement and Freire's (1989) concept of praxis, I engaged in an eight stage research design process aimed at addressing the immediate community needs that stemmed from the impact of Cyclone Idai, and at collecting the important socio-ecological data needed to inform a long term project proposal. This research process took place at the intersection of my review of the literature and the lived practice of implementing the research, resulting in three key outputs:

1. The formulation of the research design flower that helped guide my project planning process;
2. A collection of raw socio-ecological data that contributed to defining the problem setting, identifying enabling conditions, surfacing insights and opportunities, highlighting potential challenges and constraints and, finally, recognising limitations; and
3. A set of design principles that helped to guide the project planning process, and to connect theory with practice.

Collectively these three outputs helped to inform the project proposal and to create a golden thread woven from my past development work with the community of Ndeja, the unfolding research process and the future oriented project proposal.

Finally, Chapters 5 to 7 presented and discussed the research results, albeit in the form of an LFM project proposal. The big picture goal of the project proposal is to foster a locally relevant, ecologically sustainable and economically viable community development model for the broader community of Ndeja. It aims to reduce multidimensional poverty, contribute to flourishing futures for community members and help regenerate the local ecosystem. To reach this goal, the project is designed to enhance the capacities and capabilities of the broader community of Ndeja to access and utilise critical resources and assets in the water, energy and food nexus thereby contributing to local livelihoods and a positive shift in local quality of life. The guiding long-term philosophy is to build a foundation for an adaptive comanagement ecosystem governance arrangement to emerge, one which would empower and give agency to the local community to take a more direct role in guiding community interventions and achieving long term sustainable development goals.

To operationalise this long term philosophy, the project proposal has a number of shorter and medium activities aimed at empowering community members to develop the freedom and agency to utilise local livelihood assets for meaningful outcomes. These activities can be broadly grouped into seven main categories:

1. Community consultation;
2. Baseline data collection;
3. Manual borehole drilling;
4. Agroecology livelihood training;
5. Agroecology youth activist and educational programmes;
6. Community extension services; and
7. Leadership development, knowledge sharing and network building.

Within these categories each of the specific activities are designed to build on each other such that the outputs of each contribute to the larger goals and objectives of the project proposal. To track progress towards these larger goals and objectives, the project proposal includes a multiple evidence based monitoring and evaluation framework. The core of the framework is based on stage specific (capacity building stage vs. capability building stage) indicators that measures community members increasing access to the five forms of livelihood capital (human, social, physical, financial and natural). To objectively verify progress towards these indicators and to ensure the project is operating within the ecological carry capacity of the broader region, the project proposal will integrate an ecological impact assessment and multidimensional poverty survey at the start (year 1) and end (year 5) of the project. Finally, to complement these more technical, top down and widely recognised data collection methods, the project will embed a set of locally relevant guiding principles that are developed and refined through an extensive ongoing community consultation process. The goal of these guiding principles is

to stimulate community feedback, promote social learning and surface opportunities to amplify generative and locally relevant project outcomes

8.3. Next Steps

From this unfolding research journey a number of next steps have arisen to disseminate, leverage and amplify the results and outputs of the research. The first step would be to condense the contents of this thesis into a succinct and meaningful academic journal article. Although the depth of this thesis provides richness, to more effectively and efficiently disseminate the results, a more concise version that draws out and summarises the main findings is needed. The need to condense and develop a succinct summary also applies to the project proposal. A project brief that includes the LFM and a summarised project budget would help for more broadly sharing and disseminating the project proposal with potential funders and donors.

The second would be to translate the results, the journal article and the project proposal brief into Portuguese. This translation is essential in building support from within Mozambique as well as from other lusophone countries, organisations and individuals. Translating the results would open opportunities to communicate and share results with universities, government officials, local Mozambican NGOs and other national and international stakeholders. It would also open opportunities to share, collaborate and cross pollinate with other lusophone countries in Africa (Angola, Guinea Bissau, Sao Tome and Principe and Cabo Verde) as well as Brazil.

The third step would be to disseminate the results and seek out funding partners and other potential partner organisations. As a grassroots, community based organisation, LDCN currently has relatively limited financial and administrative capacity to implement the project proposal. As such, we need to actively seek out potential funding partners and/or implementing partners who are willing and able to work with and collaborate on project implementation. LDCN is open to a number of funding arrangements although our ideal partner would possess two key characteristics. First, the ability to provide administrative and accounting support. Successful funding would significantly increase the budget and reporting requirements of LDCN. Our ideal funding partner would help LDCN expand and enhance its practices for financial and administrative bookkeeping and contribute to the long term organisational development of LDCN. The second characteristic of the ideal partner would be an organisation that has the ability to help facilitate vertical linkages with regional, national and international institutions. LDCN has struggled to build meaningful relationships with larger more established organisations, government authorities and businesses. Working with a larger, more recognisable and established organisation with key linkages would significantly add to the catalytic long term potential of the proposed project. In other words, LDCN is looking for a funding partner to adaptively comanage the project with LDCN.

In addition to seeking out and disseminating the project proposal to potential funders, LDCN will also disseminate and build support from other smaller and medium sized regional organizations as potential

collaborators and implementing partners. The project proposal could very easily be expanded to include other implementing partners in other districts, thereby enhancing the scale and scope of project activities. As part of our stakeholder analysis, LDCN has identified a number of potential regional collaborators and partner organisations. Disseminating the project proposal and developing these types of horizontal links and networks could subsequently contribute to leveraging funding from larger organizations.

Should LDCN fail to secure funding, the project proposal would nevertheless provide a road map for the future development of LDCN's community development work in the Ndeja region. Moving forward, the fourth step would be to adapt the project implementation strategy and the project proposal for a range of funding options. This would include identifying and elaborating pragmatic next steps that would be economically viable within LDCN's current budget along with other incremental increases in funding. This will also help expand the range of funding mechanisms and donor organisations available to LDCN. The project proposal presented in this thesis represents the ideal future funding scenario, however, it does not necessarily represent the most realistic. It would be necessary, then, to develop a range of options and trajectories to continue to build on the successes of the research process and to work towards LDCN's longer term goals.

The final step would be to consider how to adapt and apply the research design and the research results to other problem settings and situations. While working on this thesis, I have had the opportunity to live and study in South Africa. This has allowed me to expand my network, develop relationships and collaborate with organisations outside of Mozambique and throughout Southern Africa. Although this specific proposal is adapted and designed for central Mozambique, the processes, concepts, principles and theories can be adapted and applied to other settings. As such, the final step would be to consider how I can amplify and leverage the depth of learning that took place during my research journey and to subsequently apply it and share it at a broader level.

8.4. Final Personal Reflection

Over the last ten years I have struggled with the increasingly polarised and dualistic nature of society; whether it has to do with politics, race, socio-economic class, climate change, sustainable development or any of the other problematic socio-ecological tensions, conflicts or wicked challenges we face as a planet. Often times it feels like as a collective society we are losing the empathy, tolerance and vulnerability needed to navigate the breadth and depth of crises we face as a planet. As Freire (1989) reflects, the dominant status quo uses a logic of divide and conquer to reduce people to a narrow trajectory that reinforces oppressive structures and attitudes in society. This homogenisation of society devalues and provides very little space for openness, creativity and diversity to express themselves in meaningful and generative ways. Without the ability to sit in the raw and painful contradictions that exist within ourselves and the world, we will be unable to approach the most important themes and challenges of our times (Brown 2004).

This idea of sitting in raw and painful contradictions was a reoccurring theme throughout my research journey. Mezirow (1981) notes there are two general paths towards perspective transformation: one is a series of small transitions that gradually shifts one's perspective, while the other is an immediate rupture that provokes a sudden insight. In many ways this research process is the intersection of these two paths. On the one hand, eight years of working in the community of Nguinea had gradually and incrementally altered my perspective regarding the best way to approach sustainable development. On the other hand, Cyclone Idai was a profound and immediate rupture that altered the way I perceived the world. Both paths provoked a painful awareness of the contradictions in implementing sustainable development interventions.

Perhaps the greatest insight I have gained through this process is a need for what Brown (2004:89) calls an "openness of mind and heart." Implementing sustainable development projects requires us to be simultaneously firm and yet gentle in our commitment to change, to listen deeply, to observe honestly and to critically reflect on the world (Brown 2004). It entails developing a multi-dimensional awareness and recognising the diversity of motivations, tensions, opportunities, competing interests and values that are present in a given situation. As Rodgers et al. (2013:31) states, "it means that while navigating challenges of a complex social-ecological system, one holds one's own strong opinions lightly".

Although international social work can and has been distorted and abused as a means to manipulate and further entrench unequal and oppressive systems, in its purest form serving others is a humbling experience and an expression of love (Freire 1989; Brown 2004). As Gandhi so poignantly reflected, "the best way to find yourself is to lose yourself in the service of others." Throughout this research process, I was able to rediscover myself and my beliefs regarding sustainable development through the humbling experience of serving others. Although the knowledge, skills, connections, resources and academic titles that have come from this learning journey are all important outcomes, ultimately, when I reflect back on this experience, this is what I will remember – finding myself in the service of others!

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Appendix A: Project narrative

1. Year 1 – Planning and Preparation (Framing and Exploring)

The goal of year one is to prepare, plan and initiate project implementation. To do so we will engage in an extensive community consultation process to refine the project design. This will help inform and improve our initial implementation strategy and establish a starting point for project activities. We will also seek out and collect community feedback to refine project goals and to determine how to evaluate success from the perspective of the community. To complement this community consultation process, we will also collect important socio-ecological baseline data through a multi-dimensional poverty survey and through an ecological impact assessment. This baseline data will help track progress on key project indicators as well as ensure that the project is operating within broader regional ecological thresholds. Having completed the community consultation process and the baseline data collection, at the end of year one we will initiate capacity building activities to help facilitate a smooth transition to year two of the project.

1.1. Community Consultation

Prior to the implementation of direct project interventions, LDCN will engage in a community consultation. The design of the project (as presented here) is the result of previous feedback from the community. As such the focus of the community consultation process will be to build off this feedback as well as past activities and interventions to enhance and refine the project implementation strategy. More specifically, the community consultation process will include a number of formal and informal processes aimed at:

- Maintaining direct two-way communication between LDCN and the local community;
- Establishing a point of contact for community members to provide feedback and voice concerns;
- Defining expectations, roles and responsibilities for both community stakeholders and LDCN;
- Communicating and discussing the project's intended purpose and design;
- Obtaining feedback and addressing questions and concerns from the broader community;
- Identifying initial project benchmarks, indicators and evaluation criteria for evaluating success from the perspective of the community;
- Identifying initial project participants, beneficiaries and other key community stakeholders;
- Engaging in a participatory mapping exercise to identify key community assets and livelihood strategies as well as to demarcate the locations for project interventions (including sites for drilling boreholes, demonstration farm sites and a community conservation area); and
- Mobilising and securing broad community consensus and buy in for project activities.

The target audience for the community consultation process will include:

- Local community members and neighbourhood leaders;
- Local leaders, religious leaders and traditional healers/authorities;
- Local associations and community-based groups and organisations;
- School leaders; and
- Local and district level government officials.

1.2. Socio-ecological baseline data collection

In addition to engaging in a community consultation and outreach programme, LDCN will also develop and refine the technical design of the project by integrating an ecosystem impact assessment and a multidimensional poverty survey. The goal of this data collection process is to develop baseline data that is relevant to key nexus resource nodes and to ensure we are working within key ecological thresholds for sustainable development. To complete the assessments and collect this important baseline data, LDCN will partner and work with graduate level students and professional consultants. LDCN project leadership will help guide and facilitate the assessments and data collection whereas the graduate students and professional consultants will provide technical support and independent verification.

1.2.1. Ecological Impact Assessment

The ecological impact assessment will focus on collecting key baseline data. Utilising this data, the goal is to evaluate the potential ecological impact of a range of project activities in four key areas:

1. Hydrology
2. Biodiversity
3. Soil Conditions
4. Land Use/Land Cover (GIS)

The intention of the data collection process is to validate and complement the community consultation process through a multiple evidence based approach that not only helps surface synergies and insights into different forms of knowledge production, but also serves as a fail-safe by shedding light on potential incongruencies. The results from ecosystem impact assessment will be used to triangulate findings from the community mapping exercise to support and/or refine the project design. The results will also help ensure that the project stays within the carrying capacity and broader ecosystem boundaries of the local bioregion.

1.2.2. Multidimensional Poverty Survey

The multidimensional poverty survey will focus on collecting multidimensional poverty statistics through a household survey across the different neighbourhoods where project activities will take place. The choice to use a multidimensional poverty index is that it provides a more nuanced understanding of the intensity and

type of poverty individual households and the broader community face. The three dimensions normally represented in a multidimensional poverty study (health, education and living standards) also correlate to critical assets in each of the WEF resource nexus nodes and to the various forms of livelihood capital in the SLA (social, human, physical, natural and financially). Mozambique was the first African nation to adopt and develop a multidimensional poverty index. As such, it is a widely accepted indicator that can be used to measure, verify and externally justify project impacts at a community level, while also serving as a useful reference and tool to compare project impacts across broader regional, national and international trends.

1.3. Capacity building

The primary focus of year one will be to engage with the community, refining project design and collecting important socio-ecological data. By the end of year one, we will transition to implementation of capacity building activities.

1.3.1. Manual Borehole Drilling

By the end of year one, we will host a manual borehole drilling vocational training for 20-30 community members. Manual borehole drilling is an innovative drilling technique that significantly reduces the cost and logistical difficulty of drilling boreholes in less accessible and rural areas in the developing world. It uses machines, equipment and tools that can be found or produced locally and the drilling process does not require any previous training or experience. A drill team consists of approximately 8-10 individuals and our goal is to train and equip two drill teams. The training generally takes about one month and includes the drilling of at least ten boreholes in the local area. An external trainer will facilitate the training after which time LDCN will provide support to the local drill teams as part of our ongoing capacity and capability building activities.

2. Year 2 – Community Capacity Building and Nexus Development (Deciding and Experimenting)

In year two, the focus shifts from preparation and planning to direct project implementation. The goal of year two is to implement targeted capacity building activities that enhance the skills and knowledge of community members while also contributing to improved water – energy – food nexus outcomes at a community level. Activities will be centred around three focus areas. First, is to develop and implement a community agroecology vocational training programme for local women in the community of Ndeja. Second is to develop an agroecology youth education and activist programme in partnership with the Ndeja Primary School. Third, is to expand our community manual borehole drilling programme and to continue working with the local drill teams to enhance their collective capabilities. At the end of year two, LDCN project leadership will facilitate a reflection process with project participants to develop a locally relevant and project specific evaluation process. We will also convene an annual community meeting to track progress towards community benchmarks and solicit community feedback on initial project activities.

2.1. Capacity building

Year two capacity building activities will be focused on piloting an agroecology livelihood training programme in the Ndeja community and initiating an agroecology youth education and activist programme with the Ndeja Primary School. Ndeja is the largest of the three target communities and its school leadership is the most well organised. Starting in Ndeja will provide the most support for initiating project activities, and furthermore allows us to work with a larger number of beneficiaries over the duration of the five year project proposal.

2.1.1. Agroecology Livelihood Training Programme

The agroecology livelihood training programme will be a 12 month vocational programme for a cohort of 10-15 local women. The training will take place on a livelihood demonstration farm located in the community. The training programme has three core objectives:

- To demonstrate and teach agroecology farming techniques through monthly workshops;
- To grow food for the school feeding scheme; and
- To evaluate the livelihood potential of agroecological farming practices through demonstration and collaborative data collection with programme participants and beneficiaries.

LDCN will provide the inputs for the livelihood demonstration farm and LDCN's agroecology extension officer will manage and coordinate activities with the local women participants. Women participants will earn a small stipend for their work on the farm as well as targeted incentives based on participation and evaluation of activities. Upon completion of the 12 month training programme, the women will become eligible for continued support through an agroecology livelihood extension programme aimed at supporting women transfer their knowledge for meaningful personal outcomes (see year 3 for more details).

2.1.2. Agroecology Youth Activist Programme

Year one of the agroecology youth activist programme will be broken up into two separate activities. First will be a one time agroecology training for the teachers and directors of the Ndeja primary school. Second will be the initiation of educational activities with local school youth, focused on fun and practical agroecological conservation practices.

1. Teacher Training

The agroecology teacher training will be an intensive six day training for the school teachers and the director of the Ndeja primary school. The training will have a number of key curriculum goals including:

- Introducing the concept and principles of agroecology and connecting it to important concepts surrounding climate change, ecology and the sustainability;
- Exploring how the concept of agroecology is relevant to the local community and bioregion;
- Participating in practical exercises and demonstrations related to agroecology;
- Brainstorming and developing possible agroecology activities for school children; and
- Developing a job description and evaluation criteria for a school agroecology coordinator.

At the end of the training, the participants will nominate and vote for an agroecology coordinator at the Ndeja School based on the job description and evaluation criteria developed during the training programme. The school agroecology coordinator will work with LDCN to help organise, mobilise and coordinate the agroecology youth activist programme for local children. This position will have a number of built in incentives and perks based on a performance evaluation by LDCN, the other teachers and the local school director.

2. Agroecology Youth Activists Programme

The agroecology youth activists programme will focus on involving school children in the conservation and ecological development of the community. The agroecology activists' programme will focus on fun and practical activities that help to build the natural resource base of the local community. These monthly activities will be developed and facilitated by the school agroecology coordinator and overseen by LDCN's agroecology coordinator. The budget for educational activities will be managed collectively between LDCN and the agroecology school coordinator. The core activity will be to raise tree seedlings in a school nursery and plant them in the community conservation spaces. Additional activities will be developed by the agroecology school coordinator and could include:

- Disseminating information and building awareness about local conservation issues;
- Participating in a trash pick-up and recycling programme;
- Introducing STEM (Science, Technology, Engineering, Mathematics) related education programmes; and
- Contributing to school food production.

It is expected that the Ndeja agroecology coordinator will also coordinate with the women from the agroecology livelihood training programme and occasionally involve youth participants in supporting food growing activities that support the local school feeding scheme. In doing so, the livelihood training garden will also serve as a teaching tool and as a demonstration space. Ultimately, the goal of the agroecology activists programme is to develop youth custodians for community conservation who will have the skills and knowledge to contribute to the long term and regenerative process of rehabilitating local ecosystems and promoting local biodiversity.

2.2. Year 2 capability building

2.2.1. Manual Borehole Drilling Programme

Having received the initial training, equipment and tools for manual borehole drilling in year one, in year two, LDCN will continue to work with the local drill teams to develop the capabilities needed to sustain a long term community borehole drilling campaign. This capability building phase of the manual borehole drilling programme will take place over three years (years 2 – 4) and includes three main areas: continued practical experience, new skill development and organisational development support.

1. *Continued Practical Experience*

In order to refine and improve their manual borehole drilling skills, both local drill teams will be contracted on an annual basis (for up to 3 years) to drill 10-20 boreholes per year. The goal of this community drilling campaign is to ensure community access to clean water while at the same time ensuring that the drill team has the opportunity to become professionals in manual borehole drilling. This borehole drilling programme will be overseen and managed by LDCN's Water Coordinator who will provide technical and logistical support. As part of the yearly contract and community drilling programme, each drill team will be expected to exchange their labour for every second borehole drilled to pay off the equipment and tools needed for the drilling process.

2. *New Skill Development*

In addition to refining their manual borehole drilling skills, LDCN will provide opportunities for continuing education and skill development related to access to water and sanitation. Potential future workshops and trainings will include:

- Identification of where to drill boreholes;
- Pump fabrication and maintenance;
- Rain water collection systems and storage tanks (including ferrocement building techniques);
- Ground water recharge systems; and
- Building of improved latrines.

These trainings are meant to complement previous trainings and further equip the drill team with a diversity of practical and marketable skills.

3. *Organisational Development Support*

Initial organisational development support will focus on providing logistical and planning services. This will include, but not limited to, technical support, tracking inventory, caring for and storing equipment, developing roles and responsibilities within the drill team and planning and scheduling activities. As the drill team progresses and develops greater autonomy, the LDCN Water Coordinator will shift towards supporting activities related to:

- Developing an organisational structure;
- Formally registering with the appropriate local and provincial authorities;
- Setting up a bank account;
- Budgeting and financial record keeping;
- Developing a business model; and
- Marketing and business development.

To facilitate this capability building process, LDCN's Water Coordinator will host quarterly workshops and monthly follow-up meetings with the drill team over the three year duration of the borehole drilling campaign (years 2-4). Ultimately, the drill team should progressively develop towards an entity that has the capability to function independently and to seek out opportunities, as well as the agency to negotiate and collaborate with LDCN on future drilling projects and contracts.

4. *Borehole Maintenance – Technical Oversight and Management*

In addition to the community borehole drilling programme, LDCN's Water Coordinator will also work with community leaders and the borehole drilling team to develop a long-term maintenance plan for boreholes. During our on ongoing community consultation, this will be a topic that will be approached to seek out feedback and input from the broader community. Initially, the LDCN Water Coordinator will serve as a liaison between the drill team, the community and community leadership and will provide the technical oversight and management planning needed to maintain boreholes. However, through our capability building activities focused on local leadership development, this responsibility will increasingly be passed on to community leaders and comanaged with LDCN (see year three for more details).

2.3. **Monitoring and Evaluation**

2.3.1. **Community Consultation**

At the end of year two, we will engage in a community reflection process to review initial project benchmarks, indicators and evaluation criteria developed during the community consultation process in year one. Building off this reflection process and using data that was collaboratively collected during project

implementation, we will refine and develop relevant, feasible and viable indicators to evaluate success from the perspective of the local community. These initial indicators will be focused on the outputs from the initial capacity and capability building activities and will be specifically related to:

- Access to water and maintenance of boreholes;
- School nutrition and the school feeding scheme;
- Community conservation activities and school tree planting initiatives;

This process will take place by working directly with community and school leaders and will also include, a larger community meeting. The goal of this community meeting is to receive direct feedback as part on an ongoing community consultation process as well as to maintain transparency and share a progress report to the broader community. This process will take place on a yearly basis and community indicators will be refined and updated based on the collective social learning that takes place. Ultimately, the combination of baseline data and the annual community evaluations will provide a more balanced set of criteria for evaluation of project outcomes and project successes.

2.3.2. Programme Specific Reflection

In addition to our broader community consultation process, we will implement a programme, or project specific reflection process with participants. This will be a standard yearly procedure for all of our capacity and capability building programmes and will help inform our yearly project and programme reports. The intention behind the reflection process is to directly engage with beneficiaries and participants to get feedback on activities as well as to help participants realise and articulate what they have learned and how they intend to build on that learning process. LDCN field staff will guide this process. In year two, this will take place with beneficiaries and participants of the following programmes:

- Agroecology Livelihoods Training Programme (Ndeja)
- Agroecology School Training (Ndeja)
- Agroecology Youth Activist Programme (Ndeja)
- Community Borehole Drilling Campaign
- Borehole Maintenance

A critical part of the reflection will be working with participants and beneficiaries to extend what they have learned during implementation and to set and plan towards their own future goals. This process will be critical in the transition from capacity to capability for programme participants. Furthermore, it will be used to help evaluate participants desire to engage with LDCN, ability to identify available livelihood resources and skill in adopting and implementing knowledge in meaningful and adaptive ways. In doing so, it will also help illuminate local perceptions, attitudes and affinity towards the projects approach. Ultimately, this will help to

refine and calibrate LDCN's approach to reaching our goal of empowering community led development and reducing the intensity and prevalence of multidimensional poverty.

3. Year 3 – From Capacity to Capability – Deeping and expanding project activities (Doing)

The primary objectives of year three are to expand capacity building activities to reach more beneficiaries, and to further deepen the impact of capacity building activities through targeted capability building activities. Building off pilot activities from year two, and the feedback from the community and programme specific reflection process (see year two monitoring and evaluation), LDCN will refine its implementation strategy and broaden its agroecology capacity building activities to two additional neighbourhoods and schools (Nguinea and Mazongorro). LDCN will also continue to expand its capability building support through:

- Ongoing support for local drill teams and community drilling activities;
- Offering agroecology extension services for the women graduates of the agroecology livelihoods training programme in Ndeja;
- Initiating a community agroforestry outreach programme;
- Developing local knowledge sharing networks; and
- Fostering local leadership development.

In addition to LDCN's annual monitoring and evaluation process, year three will close by developing a midway project report to track progress, to identify potential opportunities and to update the logical framework matrix.

3.1. Capacity building

Year three capacity building activities will be focused on receiving the first cohorts for the agroecology livelihood training programme in Nguinea and Mazongorro and the second cohort in Ndeja. LDCN will also expand the agroecology youth activists programme to Nguinea and Mazongorro.

3.1.1. Agroecology livelihoods training programme

In addition to receiving our second cohort of women for the agroecology livelihoods training programme in Ndeja, we will also initiate the agroecology livelihood training programmes in two additional neighbourhoods, Nguinea and Mazongorro. This will require setting up two more livelihood demonstration training farms in each of the neighbourhoods. These additional farms and training programmes will be linked with their respective local school and the food production will go towards supporting the school feeding schemes. As such, by the end of year three we will have three demonstration farms, with three cohorts of women that are supporting the three local schools.

3.1.2. Agroecology Youth Activist Programme

1. Teacher training

The agroecology teacher training for the teachers and directors of the Nguineaia Satellite Primary School and the Mazongorro primary school will be similar to the six day training the Ndeja school participated in during year two. In addition to sharing the same curriculum goals, the participants from Nguineaia and Mazongorro will also nominate and vote for an agroecology coordinator for each of their respective schools. The school agroecology coordinators will work with LDCN to help organise, mobilise and coordinate the agroecology youth activist programme. As in Ndeja, the agroecology coordinator position will have a number of built in incentives and perks based on a performance evaluation by LDCN, the other teachers and the local school director.

2. Agroecology Youth Activists Programme

Newly elected agroecology school coordinators from Nguineaia and Mazongorro will initiate and involve local youth in the conservation and ecological development of the broader community. Activities will focus on fun and practical activities that help to build the natural resource base of the local community. Initially, the core activity will be to raise tree seedlings in a school nursery and to plant them in the community conservation spaces. This will require building two additional school tree nurseries. As the programme progresses, LDCN's field staff will work with the new school agroecology coordinators to develop supplemental educational activities as well as to provide support and budgetary oversight.

3.2. Capability building

Year three capability building activities will be focused on continuing support for the manual borehole drilling teams as well as initiating agroecology extension activities, building local knowledge sharing networks and fostering local leadership.

3.2.1. Manual Borehole Drilling Programme

In addition to their continued skill and organisational development support, drill teams will continue to drill boreholes (10-20 boreholes/year) as part of the community borehole drilling campaign. By the end of year three, the drill team will be expected to have drilled enough boreholes to provide access to clean water for at least 60 percent of the target population. Drill teams will be expected to increasingly operate independently of LDCN logistical and technical support. Quarterly workshops will also shift and focus more on financial planning and developing an organisational structure. By the end of year three, the drill teams will be a formalised and legalised entity with a governing structure and bank account.

3.2.2. Extension Services

LDCN's extension services will be focused on supporting women graduates from the agroecology livelihoods training programme and utilising their new capacities to deepen and expand support for the local community. This will be done through two main interventions: an agroecology extension service and an agroforestry outreach programme.

1. *Agroecology Extension Services*

LDCN's agroecology extension service will be aimed at supporting women graduates of the agroecology livelihood training programme. Initially, this support will be focused on providing design support, technical services and inputs for women who have successfully completed the agroecology livelihood training programme and are interested, committed and motivated to implement activities on their own farms and in their own homes. As part of their final reflection and evaluation of the livelihood training programme, women graduates will identify if, where and how they would like to move forward with the knowledge and skills they developed from the agroecology training programme. LDCN's agroecology extension officer will then support these women with different inputs and extension services to help them reach these goals. Although the agroecology extension services will primarily be focused on providing physical, natural and human capital, the long-term goal of the extension programme is to also provide opportunities to increase access to financial and social capital, thereby enhancing access to all five forms of livelihood capital.

2. *Community Agroforestry Outreach Programme*

In exchange for the above extension services, the women agroecology livelihood graduates will contribute to a community agroforestry outreach programme. The programme is designed to provide local families the opportunity to access home scale solar panel systems and improved firewood cooking stoves in exchange for household tree planting. Women graduates will care for neighbourhood tree nurseries in which tree seedlings will be used to support neighbouring families in an agroforestry tree planting initiative. The goal is to plant at least 7,500 trees with 50-75 families in years three, four and five. As part of the outreach programme, the goal is also to build a firewood saving rocket stove with each participating family. Families who participate in the programme, successfully plant trees on their land and build a firewood saving stove will subsequently receive a home scale solar panel system to enhance household access to energy. The programme is designed to provide neighbourhood level accountability and oversight to help ensure that the women graduates care for and provide the tree seedlings for participating neighbouring families.

In addition to caring for the tree seedlings, the women graduates will be expected to demonstrate on their own land how the tree seedlings will be planted and subsequently provide guidance to the neighbouring families when it is their turn to do so. The basic design of the tree planting will be taught during the agroecology

livelihood training programme and follows an agroforestry design in which a combination of indigenous hardwoods, improved fruit and nut trees and fast-growing leguminous trees are planted along the perimeter of a farm.

Although, the programme is incentivised by providing access to solar panel systems, by planting and caring for these trees, families will also gain the immediate and long term ecological benefits of growing trees. Whereas the fast-growing leguminous trees will help soil fertility and provide a sustainable source of firewood, the fruit and nut trees will contribute to food security and the indigenous hardwoods will provide a potential long-term income. All the while, in addition to these benefits, the tree planting initiative will also help rehabilitate the local ecosystem and provide future livelihood opportunities such as beekeeping.

3.2.3. Leadership Development & Knowledge Sharing Networks

To enhance peer to peer learning and meaningful experiential learning, LDCN will foster local knowledge sharing networks and communities of practice for community members and project participants to share experiences. Although the long-term goal of fostering these learning networks is to develop social cohesion, cooperation, collective action and horizontal support networks, the objective in year three is to create and prepare the space for these outcomes to emerge in a locally meaningful way. This will be done through three initiatives: integrating past women graduates of the agroecology livelihood training programme as peer mentors for current participants; developing a quarterly meeting for the three agroecology school coordinators to meet and collaborate; and initiating a leadership development programme with local community leaders.

1. Agroecology peer mentorship programme

As part of the agroecology livelihood training programme, a cohort of 10-15 women participants will train and work on a local livelihood demonstration farm for 12 months. In order to facilitate the transition from one cohort to the next, former women participants will serve as peer mentors during a six month transition period in order to help sensitise and integrate current participants during the initial stages of the programme. In year three, we will initiate this programme in Ndeja by inviting women graduates, on designated days, to aid LDCN's agroecology extension officer in facilitating lessons and experiences. In doing so, former women participants will be empowered to become peer to peer mentors and to help lead activities.

The ability to articulate and pass on information and knowledge can help aid in the transition from the capacity building stage to the capability building stage. Through the peer mentorship programme women will have an opportunity to practice this process and find their voice by communicating with current participants about what and how they learned during their time in the training programme. This process is also beneficial in that former women participants are better suited to teach material in a relevant and relatable way for current participants.

In addition to this peer to peer learning, LDCN will also plan and schedule a variety of different field trips for current and past participants to engage and share in a mutual learning process. Some of the potential field trips include:

- Visiting a syntropic coffee growing project in the Gorongosa mountains;
- Visiting an agroforestry and livelihoods development centre;
- Visiting a community based essential oil and cosmetics factory;
- Visiting local farmers associations to learn about different irrigation methods; and
- Visiting a medicinal garden at a holistic healing centre.

The intention of these field trips is to share meaningful experiences, foster a broader horizontal network and learn how different techniques and methods can be used and adapted, in variety of ways, to achieve a diversity of goals. Ultimately, the goal is to foster a collective social learning process that inspires and integrates people and ideas.

2. *Quarterly Agroecology School Coordinator Meetings*

Introducing the youth agroecology activist programme into the three local schools creates an opportunity to link the schools and develop a broader collective youth agroecology action network. Rather than creating isolated islands of school tree planting initiatives, by linking the school agroecology coordinators, LDCN will lay the foundation for potential catalytic collaboration of larger scale, regenerative agroecology initiatives. To do this, LDCN will host a quarterly meeting with the school agroecology coordinators to collectively discuss opportunities, plan initiatives and troubleshoot challenges. As part of these quarterly meetings, and school to school collaboration, LDCN will reserve a portion of the agroecology youth activist budget as collective action fund to be managed with all three school agroecology coordinators. This budget will be a flexible budget that can be used for a diversity of activities that may include:

- Hosting field trips or camps for youth leaders to visit pristine natural spaces;
- Developing a collective agroecology youth livelihood project;
- Building partnerships with other regional schools, businesses or projects; and
- Investing in educational material to be shared across the schools.

The goal of these quarterly meetings is to empower the agroecology school coordinators to increasingly see themselves as leaders and to imagine ways to amplify the impact of their individual efforts through a broader network building process.

3. *Local Leadership Development Programme*

Stemming from the initial and immediate need to provide community oversight of borehole maintenance, LDCN will be in continual conversation and coordination with local leaders from all three communities where project activities are taking place. However, in year three, we will seek to formalise this coordination process by developing a local development council. The formation of this leadership council will be accompanied by a leadership training programme that will take place through quarterly meetings. The goal of these leadership development activities are to:

- Develop a consistent and cohesive approach in providing oversight and management of LDCN project interventions;
- Reflect on and track progress on programme and project outcomes;
- Help disseminate important information to community members;
- Open an ongoing line of communication and dialogue process surrounding collaborative efforts between LDCN and the community;
- Engage in conversations about long-term roles and responsibilities for managing community development and the needs and opportunities associated with these roles and responsibilities;
- Provide transparency and inclusion in the design, budget and implementation of activities.

The core participants and audience for this leadership training are the “secretarios dos barrios”, or the locally recognised government liaisons, and other local community members and programme participants that emerge as leaders during the first two years of project implementation. This group may also expand to include religious leaders, traditional leaders, village elders, school leadership and other community stakeholders. The focus of year three is to identify these local leaders and collectively establish the values and objectives of the development council and leadership training activities. These quarterly meetings will continue through the end of the project (years three to five) and will play an increasingly important role in deliberating and negotiating the pathways for sustaining project outcomes after the official project closure in year five. The long term goal of this process is to lay the foundation for a broader community governance structure to emerge, one in which community leaders have the capacity and the capability to collaborate and adapt to the shifting needs and opportunities and thus to improve the wellbeing of the community and the local ecosystem.

3.3. Monitoring and Evaluation

3.3.1. Community Consultation – tracking and refining community indicators

At the end of year three, as part of our ongoing community consultation process, we will host a community meeting to share a yearly progress report with the community and to receive direct feedback surrounding project activities from the community. More specifically, we will track and report on the key benchmarks,

indicators and evaluation criteria developed and refined through LDCN's ongoing community consultation. We will review the activities and the outcomes of interventions and compare them to the goals identified at the start of the year.

Of particular relevance in year three is to review the piloting of our agroforestry outreach programme in Ndeja, and to receive feedback around the introduction of a local development council to help monitor and comanage activities moving forward. As part of this process, we will reflect on the challenges and tensions that may arise as well as to identify what was successful and how to build on those successes. Based on the feedback from the community, we will recalibrate expectations and activities and set goal for year four.

3.3.2. Programme Specific Reflection

Year three is a critical year in the project as its focus will be to deepen and expand on initial capacity building activities. As such, the programme specific reflection will be multi-layered and will shift, -depending on where participants and beneficiaries are on the capacity – capability spectrum. As in year two, the intention behind the reflection process will be to directly engage with beneficiaries and participants to get feedback on activities as well as to help participants realise and articulate what they have learned and how they intend to build on that learning process. LDCN will guide this process, and in year three, this will take place at a community and programme specific level as well as at a broader project level across all three communities.

In Ndeja, evaluations will take place with the beneficiaries and participants of the following programmes:

- Agroecology livelihood training programme (Cohort 2), including the integration of the peer mentorship programme;
- Agroecology extension programme;
- Agroforestry outreach programme; and
- Agroecology youth activist programme (Cohort 2).

In Mazongorro and Nguinea, evaluations will take place with the beneficiaries and participants of the following programmes:

- Agroecology school training programme;
- Agroecology livelihood training programme (Cohort 1); and
- Agroecology youth activist programme.

At a broader project level, evaluations will take place with the beneficiaries and participants of the following programmes:

- Agroecology school coordinator quarterly meetings;

- Borehole drilling campaign (including maintenance); and
- Local leadership development programme.

Once we have completed each of the programme specific evaluations, LDCN's leadership team will convene and compile a midway project report. This midway project report will help define and guide the final two years of project implementation and allow for a midway reflection to evaluate how project outcomes compare with goals and expectations.

4. Year 4 – Catalysing Nexus Capabilities for Flourishing Futures (Doing and Evaluating)

The focus of year four is to catalyse the collective capacities and capabilities of community members to help usher in a more sustainable and meaningful development trajectory towards wellbeing and flourishing futures. In all three target communities, we will have capacitated local schools and local women surrounding agroecological values, practices and farming techniques. We will continue this capacity building process with new cohorts in all three communities. As part of our capability building activities, we will continue to deepen and expand our agroecology extension and agroforestry outreach programme to all three communities. Finally, we will increasingly look to the long-term sustainability of programme activities post project funding by seeking out market development opportunities, by amplifying knowledge sharing networks and by continuing leadership development activities.

4.1. Capacity building

Year four will be the final year for capacity building programmes. Activities will focus on receiving three new cohorts of women for the agroecology livelihoods training programme, and on continuing the agroecology youth activist programme.

4.1.1. Agroecology Livelihoods Training Programme

In year four we will receive our third cohort of women for the agroecology livelihoods training programme in Ndeja and our second cohorts in both Nguinea and Mazongorro. By year four, all three livelihood training farms should be fully operational and meeting production goals. Production will continue to support local school feeding schemes at each of our three partner schools.

4.1.2. Agroecology Youth Activists Education Programme

Year four will also bring the third cohort of youth for the agroecology youth activists programme in Ndeja, and our second cohorts of youth at the both the Nguinea and Mazongorro primary schools. Programming, logistics and coordination of activities will be managed and run by the local schools and their respective

agroecology school coordinators. LDCN support will focus primarily on technical and budgetary questions as well as capability building support related to network building, leadership training and financial planning.

4.2. Capability building

Year four capability building activities will be focused on finalising the community borehole drilling campaign, extending agroecology extension services and expanding the community agroforestry outreach programme to include the communities of Mazongorro and Nguinea. As part of LDCN's agroecology extension services, we will start a market development programme aimed at inspiring meaningful and innovative agroecology livelihood opportunities. Finally, we will continue to foster local leadership and knowledge sharing networks to enhance the long term leadership needed to sustain and promote future sustainable development.

4.2.1. Manual Borehole Drilling Programme

Year four is the final year of the community borehole drilling programme and of LDCN's capability building support for local drill teams. In year four, drill teams will be operating independently of LDCN's logistical and technical support. The community borehole drilling programme will provide access to clean water for at least 75 percent of the target population. Quarterly workshops will focus on transitioning the drill teams from a community-oriented drill team towards a sustainable regional business model. These workshops will continue to focus on developing a long-term financial plan and organisational structure needed to support this transition. LDCN will also work with the drill team to find potential clients and to develop a broader regional network.

4.2.2. Extension Services

LDCN will expand its extension services and agroforestry outreach programme to include the communities of Mazongorro and Nguinea. LDCN will also pilot a market development programme concentrated on improving the production, processing and storage of local agriculture production as well as accessing improved markets and transportation services.

1. Agroecology Extension Service

In year four, LDCN's agroecology extension services will primarily focus on supporting graduates from each of the year three cohorts of the agroecology livelihoods training programmes. This support will concentrate on providing design support, technical services and inputs for women who have successfully completed the livelihood training programme and are interested, committed and motivated to put their new knowledge to use on their own farms and in their own homes. Women will be supported by LDCN's agroecology extension officer with physical, natural and human capital needed to reach self-identified goals.

2. *Community Agroforestry Outreach Programme*

LDCN will also expand its agroforestry outreach programme through year three to women graduates of the agroecology livelihood training programme. Whereas we piloted the programme in year three in Ndeja, in year four, LDCN will expand the programme to include women graduates from all three communities. The goal in year four is to plant 22,500 trees with 150-200 families across all three communities and school districts.

3. *Market Development (processing, storage and commercial markets)*

By the start of year four, the intent is to have graduated up to 50 women in four separate cohorts in three neighbouring communities (Ndeja, Mazongorro and Nguinea). Through our extension services, these 50 women will have improved their agroecology farming capability and may be producing a surplus of vegetables and other agricultural produce based on their individual activities. To enhance the value of this surplus and to avoid post-harvest loss, in year four, LDCN will initiate a market development programme to improve the processing, storage and transport of these products. This will include providing weekly transport services to local markets along the main highway to sell surplus produce. LDCN will also pilot and demonstrate innovative methods, practices and technologies for processing and storing local agricultural production including:

- Improved solar dryers;
- Improved grain storage and small-scale silos;
- Small scale cold storage; and
- Oil press for processing and making oil from local agriculture production.

Year four will focus on prototyping and testing these different solutions, analysing their economic potential and creating a viable product business plan with the women agroecology graduates. Based on the results of this collaborative process, we will also explore opportunities to expand these pilot demonstrations into larger livelihood development programmes in year five.

4.2.3. Local Leadership & Knowledge Sharing Networks

1. Agroecology peer mentorship programme

In order to facilitate the integration of the newest cohorts of women into our agroecology livelihoods training programme, we will continue to include and empower former participants as peer mentors and trainers in all three communities. Through the first six months of the agroecology livelihoods training programme, former participants will aid LDCN's agroecology extension officers to facilitate lessons and activities. In addition to empowering former participants and facilitating a more relevant and relatable peer to peer form of learning,

women will also have the opportunity to build relationships and go on field trips to visit other innovative and inspiring local initiatives. Ultimately, the goal of the peer mentorship programme is to enhance social and human capital through a supportive peer network.

2. Quarterly Agroecology School Coordinator Meetings

Through quarterly meetings, LDCN will continue to bring school agroecology coordinators together to plan collective activities, discuss opportunities, troubleshoot challenges and comanage the collaborative action fund. These meetings and the future direction of the agroecology youth activists programme will increasingly be led by the school agroecology coordinators. Year five will be the last officially funded year of the project and thus discussions will also be increasingly oriented towards the sustainability of activities and long term planning. The goal of these quarterly meetings is to empower the agroecology school coordinators to increasingly see themselves as leaders and to imagine ways to amplify the impact of their efforts during and after the funding period.

3. Local Leadership Development Programme

Having identified local leaders and established the values and objectives of the development council, year four of our local leadership training will focus on two key areas. First is that of building the capacity of local leaders to participate in the monitoring and evaluation of the project outcomes. As part of this process, local leaders will actively accompany and take part in the monitoring and evaluation process of each of the project's programmes throughout the duration of year four. At quarterly development council meetings, we will then reflect on the shared experience and responsibility for monitoring and evaluation of activities, and subsequently seek to identify both the challenges and the opportunities that arise within the process.

These reflections and discussions will then be used to build a bridge to our second focus area: the discussion of the long term roles and responsibilities for managing community development. LDCN's long term goal is not to pass on full responsibility to oversee and manage development to community leaders, but rather to teach them how to adaptively comanage development with LDCN and other community stakeholders. One of the key objectives of this discussion is to bring to the surface the necessary minimum conditions to meet the needs of local leaders and to ensure their consistent, effective and transparent participation. By bringing to light these minimum conditions, we can start to negotiate some of the inherent power inequities embedded in the community development process and to consider possible pathways for year five and beyond.

4.3. Monitoring and Evaluation

4.3.1. Community Consultation – tracking and refining community indicators

At the end of year four, as part of our ongoing community consultation process, we will host a community meeting to share the yearly progress report with the community and receive direct feedback from the community members surrounding project activities. We will review activities, and the outcomes of these activities, and compare them with key benchmarks, indicators and evaluation criteria developed and refined with the community in previous years.

In year four, a particular focus of this community consultation process will be to transparently share the outcomes of the leadership training activities and to discuss the potential role of the development council and community leaders moving into year five of the project and beyond. As year four will be the last year of the capacity building trainings, we will also collectively discuss the possibility and options for continuing these activities in the future. Finally, we will reflect on challenges and tensions that arose during year four implementation, as well as where there are opportunities to improve and grow on project successes. These discussions and reflections will be essential in helping to inform and construct a base for developing a transition plan in year five. This base will determine whether to sustain and amplify project outcomes beyond the end of project funding.

4.3.2. Programme Specific Evaluation

Year four is the only year in which all of our capacity and capability building activities will be taking place across all three target communities. As such, engaging in a programme specific evaluation and comparing results from these evaluations across all three communities offers a unique cross sectional moment to reflect on where and how success has emerged, and what the key enabling conditions were to allow for that emergence. This multi-layered evaluation process will continue to help LDCN refine and calibrate its activities and development approach.

Furthermore, the programme specific evaluation will continue to be used as a mechanism to directly engage with programme participants in a reflective learning process. The goal of this reflective learning process is to encourage participants to reflect, realise and articulate where they are on the capacity – capability spectrum and how they can continue to move forward to reach their own goals. Embedding this reflective learning process opens opportunities to identify and empower peer leaders and mentors.

LDCN will guide this programme specific evaluation process. In year four, this will take place for all of our capacity and capability building programmes in all three communities. Once we have completed each of the programme specific evaluations, LDCN's leadership team will convene and discuss how to utilise this multi-layered data set to help inform a transition plan during year five for post project continuity.

5. Year 5 – Sustainability through Adaptive Comanagement (Reflecting and Updating)

By the end of year five LDCN will have accomplished the following:

- Drilled approximately 50 boreholes to provide access to clean water for at least 75 percent of the local population;
- Trained 75 – 100 women through an agroecology livelihood training programme;
- Enhanced child nutrition by supporting three local primary schools with locally sourced food for a school feeding scheme;
- Provided agroecology extension services for the 75-100 women graduates of the livelihood training programme;
- Developed an agroecology youth activist programme in three local primary schools that is actively planting and caring for community conservation spaces;
- Planted 50,000 trees and distributed 500+ solar light systems with more up to 500 families through our community agroforestry outreach programme; and
- Built 500 firewood saving rocket stoves.

As part of the implementation of project activities to achieve these goals, project participants and the broader community will move from possessing the capacity, or access to necessary assets, for community development, to the actual capability, or the agency and ability to utilise assets, to implement community development projects. Yearly community monitoring and evaluation reports will be generated together with the local community to track and evaluate this process.

As year five will be the final year of LDCN's initial five year project proposal, the goal is to complete a final project evaluation and future oriented sustainability and transition plan. To achieve this goal the focus of year five is to:

1. Close and/or transition to comanaging interventions with the local community;
2. Implement a second ecological impact assessment and multidimensional poverty survey to compare initial baseline data collected in year one with data collected in year five;
3. Identify potential pathways forward to sustain project successes and catalyse future community and regional development.

These three activities will collectively inform a final project report and evaluation. Based on the outcomes of this process, project activities and funding may be extended as part of a longer term local and regional development strategy.

5.1. Capacity building

LDCN will no longer be involved in the direct implementation of capacity building initiatives. LDCN will continue to work with participants and leaders to transition programmes as part of our capability building activities.

5.2. Capability Building

Although LDCN will continue to provide extension services for the final cohorts of women graduates in year five, LDCN will increasingly focus on local leadership development and network building activities in order to nurture an adaptive comanagement governance structure for local and regional development.

5.2.1. Extension Services

Year five extension services will focus on continuing support for project participants to utilise the assets, skills and knowledge from capacity building training to reach individual goals and aspirations. LDCN will continue its extension services and agroforestry outreach programme with the final cohorts of women graduates of the agroecology livelihood training programme. We will also expand and deepen our market development activities based on the collaborative analysis and data collection in year four.

1. *Agroecology Extension Service*

LDCN's agroecology extension services in year five will primarily focus on supporting year four graduates of the agroecology livelihoods training programmes. This support will concentrate on providing design support, technical services and inputs for women who have successfully completed the livelihood training programme and are interested, committed and motivated to implement knowledge on their own farms and in their own homes. Women will be supported by LDCN's agroecology extension officer with physical, natural and human capital needed to reach self-identified goals.

2. *Community Agroforestry Outreach Programme*

LDCN will continue its agroforestry outreach programme by catalysing the women graduates of the agroecology livelihood training programme. Our goal for year five is to plant 22,500 trees with 150-200 families across all three communities and school districts. By the end of year five we will have planted 50,000+ trees (and distributed 500 solar lighting systems and built 500 firewood saving rocket stoves) with approximately 500 families.

3. *Market Development (Processing, Storage and Commercial Markets)*

Our market development activities will build off the results of year four activities and expand access to resources and assets for the processing and storage of agriculture produce. We will continue to enhance access to local roadside markets by providing weekly transport services to sell produce to bulk buyers, distributors and other clients. Market development activities in year five will be increasingly linked to fostering a local livelihood innovation niche by developing and expanding incoming generation activities and fostering a broader horizontal integration process of women farmers.

5.2.2. Local Leadership & Knowledge Sharing Networks

Leadership and network building activities will be increasingly prioritised throughout the project, and in year five will primarily focus on two main areas: First is the development and dissemination of information and training materials on project activities to individuals and organisations outside of the local community. Second is the development of a sustainability transition plan based on an adaptive comanagement governance structure. The goal of this adaptive comanagement governance structure and the sustainability transition plan is not meant to fully pass on responsibility to the local community but rather to foster the enabling conditions needed for collaboration, collective action and social learning. In creating and fostering these enabling conditions a more locally relevant, ecologically sustainable and economically viable approach to sustainable development can emerge.

1. Manual Borehole Drilling Training Manual

By the end of year five we will develop a community borehole drilling manual and training programme for future regional expansion. By the end of year four, the drill team should not only be capable of manual borehole drilling in a diversity of conditions, but should also be able to teach and pass this information along. We will work with the drill team leadership to develop the training manual which will include digital video clips and a digital curriculum to aid in the dissemination of techniques, methods, costs and other important information related to manual borehole drilling. In order to facilitate widespread access and disseminate information beyond the immediate district, we will develop a webpage to spread and share this open source information. The goal of generating this training manual, digital curriculum and website is to not only spread awareness but also to market drill team services and drive regional expansion.

2. Agroecology Training Manual

By the end of year four, LDCN will have trained between 75-100 women in our agroecology livelihoods training programme across three communities. All of the women will be trained on livelihood demonstration farms located in their respective communities. The produce grown during the trainings will be used to support

a local school feeding scheme. Although we will develop and refine a training curriculum for each cohort of women, in year five we will formally compile an agroecology livelihood training and extension manual based on the four years of project implementation. This manual will be oriented towards other development organisations, extension officers and practitioners thereby facilitating dissemination of information to a broader audience located outside of our immediate region. Similar to the manual borehole drilling training manual, the agroecology livelihood training manual will also include digital content and will include an associated webpage. The goal is not only to demonstrate and advocate for an agroecology approach, but also to tell the story of each of the livelihood demonstration farms and the women graduates.

3. Transition planning - livelihood training gardens, community extension services & agroforestry outreach programme

In year five, the women graduates from each community as well as school leaders, the school agroecology coordinator and community leaders, will collectively decide if and how to sustain the livelihood training farm and school feeding scheme. This will involve deliberation and planning among the different stakeholders and guided by the LDCN extension officer and project leadership. The end goal of this process will be the development of a locally relevant and economically viable transition plan for the livelihood training garden.

As part of this process, the women from each community may also nominate and elect a community extension officer to provide ongoing community extension support. This extension officer will work directly with LDCN as a community liaison during and after year five to provide ongoing extension support and monitoring and evaluation of ongoing project activities. She will receive a monthly stipend and will also continue to help implement and give continuity to our agroforestry outreach programme. LDCN will extend the agroforestry outreach programme indefinitely based on our own internal fundraising efforts after year five.

4. Horizontal Integration of Women

Through our agroecology livelihood training programme and peer mentorship, LDCN will cultivate the social relationships and human capital needed to foster a horizontal integration of women farmers. The goal of this integration process is to develop a cooperative network that can share knowledge and experiences, leverage continued support and resources, share the burden of common expenses and advocate for the role and rights of women farmers. To facilitate this process, LDCN will host a monthly women farmers forum focused on creating a safe space for women to come together and discuss potential opportunities. Initially, this will focus on leveraging LDCN's market development activities for the benefit of the collective group. However, over time, the form and function of the women farmers forum and broader horizontal integration process will depend on the women themselves. The goal is to provide a space for the women to identify opportunities to reach shared goals by overcoming challenges through mutually beneficial partnerships and collaborations.

5. *Agroecology School Coordinator Meetings*

In addition to actively participating in the decision making process surrounding the agroecology livelihoods training farm, LDCN will work directly with the school agroecology coordinators and school leadership to develop a long term plan for the agroecology youth activists programme and community conservation efforts. In quarterly meetings among the three agroecology school coordinators, a transition plan to maintain and/or extend project activities beyond year five will be developed. The school leadership as well as the teachers, community leaders and youth environmental custodians will also be involved to ensure a transparent and equitable process.

6. *Local Leadership Development*

The goal of year five is to strengthen the connective tissue and the collaborative capability of local leaders and to empower them to advocate and lead a broader regional development process. Through the collective monitoring and evaluation of project outcomes in year four, the local development council will develop first hand insight into how different programmes (focused on different nexus security challenges) function, are connected and depend on each other. Furthermore, in year five local leaders will also be involved in helping to develop the transition plans for the agroecology livelihood training gardens and the agroecology youth activist programme.

In order to integrate and connect these different collaborative planning activities, in year five, the culmination of the local leadership training and quarterly development council meetings will be to generate a community and regional development plan together with LDCN leadership. This community development plan will be developed and comanaged with LDCN and will include developing a budget for post year five funding. As part of this process, local leadership and the local development council will interact and negotiate with other local community stakeholders to develop a broad consensus. The local development council will also be expected to increasingly work and communicate with larger regional actors and more top down institutions to help leverage increasing support and sustainability funding.

5.3. Monitoring and Evaluation

5.3.1. Community Consultation

One of the primary goals of year five is a yearlong reflection and evaluation process as part of building the capability of local leadership and community networks to negotiate a feasible, equitable and sustainable adaptive comanagement governance structure. This process will include programme specific reflection and evaluation with project participants, beneficiaries and local leaders to develop specific transition plans. It will also include a broader community consultation process to track and communicate project results to the broader community and to receive feedback for a community and regional development plan. This will formally be

achieved through our annual end of the year community meeting in which community members have an opportunity to voice their feedback.

5.3.2. Socio-ecological assessments – baseline data comparison

In order to verify and triangulate findings from the ongoing community consultation process and programme specific monitoring and evaluation process, LDCN will implement an ecological impact assessment and multidimensional poverty survey to compare with year one findings. To complete the assessments, LDCN will partner and work with graduate students and professional consultants. LDCN project leadership will help guide and facilitate the assessments and data collection whereas the graduate students and professional consultants will provide technical insight and independent verification. The ecological impact assessments and multidimensional poverty survey will provide crucial data for the external evaluation of the project as these data sets are well recognised external benchmarks that carry an important weight for justifying LDCN's approach to external stakeholders.

1. Ecological Impact Assessment (EIA)

The ecological impact assessment will focus on collecting key baseline data collection and evaluating the ecological impact of project activities in four key areas:

1. Hydrology
2. Biodiversity
3. Soil Conditions
4. Land Use/Land Cover (GIS)

The intention of the data collection process is to validate and complement the community evaluation process through a multiple evidence-based approach. The ecological data will also be used to map potential future pathways and their ecological impact. Finally, the ecological impact assessment will also help ensure the community and regional development plan generated by the local development council fits within the broader carrying capacity of the broader bioregion.

2. Multidimensional Poverty Survey

The multidimension poverty survey will focus on collecting multi-dimensional poverty statistics through a household survey across the different neighbourhoods in the broader community of Ndeja. The three dimensions of poverty (health, education and living standards) correlate to critical assets in each of the WEF nexus nodes (water, energy and food) as well as critical livelihood assets. As such, the project's indicators for the logical framework matrix are tied to and reflective of multidimensional poverty indicators. As multidimensional poverty statistics are widely available for Mozambique, they offer an opportunity to

compare and situate project impacts with broader regional and national trends across the country and sub-Saharan Africa.

5.3.3. Final Report

LDCN will combine the annual community monitoring and evaluation process, the community and regional development plan generated by the local development council, and the socio-ecological impact assessments in year five to develop a final project report. Final evaluations will be based on equally weighted evaluation by:

1. The community, programme beneficiaries/participants and local leaders;
2. LDCN internal evaluation and reflection; and
3. Data analysis from socio-ecological assessment process.

Based on the outcomes of this final report, project funding and support may- or may not - be extended to broaden and deepen project outcomes in order to achieve the UN Sustainable Development Goals at a broader district and regional level.

Appendix B: Proposed Budget Summary

CATEGORY	DESCRIPTION	TOTAL BUDGET (USD\$)
ACTIVITIES BUDGET		
Community Consultation	Community Mapping	\$ 5,000.00
	Community Feedback of Project Design	\$ 5,000.00
	Participatory Community Monitoring and Evaluation	\$ 20,000.00
Baseline Data Collection	Ecological Impact Assessment	\$ 25,000.00
	Multidimensional Poverty Survey	\$ 50,000.00
Manual Borehole Drilling Campaign	Manual Borehole Drilling Training	\$ 35,000.00
	Community Drilling	\$ 50,000.00
	Continued Learning & Organisational Development	\$ 10,000.00
	Maintenance	\$ 5,000.00
Agroecology Livelihood Training	Livelihoods Training Gardens	\$ 30,000.00
	Training Program Developed and Implemented	\$ 36,000.00
	Production supports local feeding scheme	\$ 24,000.00
Agroecology Youth Activist and Education Program	Agroecology Training for Teachers and Directors	\$ 4,500.00
	School Tree Nursery Built	\$ 4,500.00
	Youth Conservation Activities & Tree Planting	\$ 60,000.00
Extension Services	Agroecology Livelihood Extension	\$ 36,000.00
	Agroforestry Outreach Programme	\$ 75,000.00
	Market Development (exact activities TBD based on community feedback)	\$ 25,000.00
Leadership Development, Knowledge Sharing & Regional Network Building	Agroecology School Coordinator Meetings	\$ 50,000.00
	Agroecology Peer Mentor Program	\$ 25,000.00
	Horizontal Integration of Women Farmers	\$ 2,500.00
	Sustainable Development Council	\$ 10,000.00
	Training manuals created	\$ 10,000.00
HUMAN RESOURCES		
Director	International Director	\$ 180,000.00
Field Staff	Water Coordinator	\$ 30,000.00
	Project Manager	\$ 90,000.00
	3x Agroecology Extension Field Officers	\$ 60,000.00
	4x guards	\$ 36,000.00

	Driver	\$ 15,000.00
Administration	Project Administrator/Book Keeper	\$ 45,000.00
	Accounting Services	\$ 50,000.00
OPERATIONS		
Office	Office	\$ 50,000.00
	Equipment	\$ 10,000.00
	Monthly supplies	\$ 9,000.00
Communication	Airtime	\$ 6,000.00
	Internet	\$ 10,000.00
Transport	Vehicles	\$ 30,000.00
	ATV	\$ 3,500.00
	Motorbikes	\$ 7,500.00
Other	Maintenance	\$ 20,000.00
	Insurance	\$ 10,000.00
	Air Travel	\$ 15,000.00
	Petrol	\$ 30,000.00
TOTAL PROJECT BUDGET SUMMARY		
Total Budget	Activities total	\$ 597,500.00
	Human resources total	\$ 506,000.00
	Operations Total	\$ 201,000.00
	Direct Total	\$ 1,304,500.00
	Donor controlled flexible investment fund (10% of direct total)	\$ 130,450.00
	Contingency (5% of direct total)	\$ 65,225.00
	FINAL PROPOSED BUDGET	\$ 1,500,175.00