

Understanding dynamics of farmer-led innovation in the growth of small/smallholder commercial agriculture in Mozambique

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Summary

Mozambique is a country that lacks strong state institutions and has a turbulent history, the civil war coming to a close as recently as 1992. In the absence of government support which addresses the needs of the rural population, the majority of which are engaged in agriculture and live in poverty, and the ephemeral nature of development interventions, a considerable responsibility falls on farmers to be drivers of development in agriculture. This is especially true of processes of farmer-led irrigation development, which is expanding rapidly across SSA and is becoming an increasing focus of academia and international development organisations alike. Understanding the dynamics which underpin these farmer-led processes of development can provide invaluable insights that can facilitate moves towards supporting, rather than controlling, agricultural development. While modern literature has transcended the idea that the spread of innovations in agriculture can be attributed to the extrinsic characteristics of innovation or potential adopter, and come to greater appreciate the social dynamics which drive such processes, the exact nature of these social dynamics requires further attention. Furthermore, such studies generally focus on who does share and receive knowledge, rather than those who are excluded from engaging with such innovations. As such, this research aims to understand how innovation spreads in farmer-led processes of (irrigation) development in central Mozambique.

This study was undertaken using an ethnographic approach to gain an emic understanding of these processes, as farmers experience them, and understand the barriers which face farmers trying to adopt given innovations from the same perspective. Rather than focusing on all innovations simultaneously spreading through various channels, a case study was performed on the spread of two complimentary sets of innovations which are currently facilitating smallscale farmers entering into commercial fruit production. These are innovations related to the growing of litchi trees and those pertaining to irrigation development, a prerequisite for farmers who wish to enter into this industry. The findings of this research corroborate other findings from Mozambique that innovations are generally transmitted in small social networks of highly connected individuals, mainly through networks of family and friends/neighbours. Learning by observation alone was found to play a minimal role in the spread of such innovations, attributable to both the social dynamics above and the highly specialized nature of knowledge associated with these innovations. The current wave of farmer-led development through which these innovations are spreading to the wider community in Inhazonia are found to be built upon processes of elite capture facilitated by clientelism and, as such, raises important questions about these two processes, which would generally be juxtaposed to one another.



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List of Abbreviations

ARA - Administrações Regional de Aguas

FRELIMO - Frente de Libertação de Moçambique

ILP – Irrigated litchi production

LGA – Litchi growers association

MLGA – Manica Litchi Growers Association

MZN - Mozamican medicals

NGO – Non-governmental organisation

RENAMO - Resistência Nacional Moçambicana

SDAE - Servicios Distritais de Actividades Económicas

1. Introduction

1.1. Background

In both project design and academia, there is a growing resistance towards traditional approaches to development, which are characterised by top-down, technology driven solutions to the problems of less developed countries (Bont, Liebrand, Veldwisch, & Woodhouse, 2019; Nkoka, Veldwisch, & Bolding, 2014; Thompson & Scoones, 2009; Woodhouse et al., 2017). Such hallmarks are conspicuously present in the history of irrigation and agricultural development in particular, where the supply of external technologies and practices have long been understood to be a panacea to the perceived failings of the agricultural sector across the global south (Besley & Case, 1994; Bont, 2018; Thompson & Scoones, 2009). Extension services designed to modernise farming in such countries, with the aim of concomitant commercialization and reorientation towards export, have failed many of the communities and individuals they were established to aid however (Cunguara & Moder, 2011; Davis, 2008; Davis & Mekonnen, 2012). This global trend serves as the backdrop for a growing appreciation of more inclusive models of development, which can potentially build on processes of ‘farmer-led irrigation development’ in Africa. While farmer-led development refers broadly to bottom-up developments in agriculture, farmer-led irrigation development refers specifically to this phenomenon within the realm of irrigation.

In today’s research and policy debates, the idea that smallholders can be a driving force in irrigation expansion is increasingly accepted and discussed. Academics have coined the term ‘farmer-led irrigation development’ to call attention to the dominant mode of irrigation expansion in Africa (Beekman, Veldwisch, & Bolding, 2014). Having come to appreciate development in this new light, it is important to understand the dynamics of these farmer-led processes of development, such that efforts can be directed at supporting, rather than managing, individuals and communities. Increasingly, we are coming to understand that social dynamics, rather than advances in technology, are a limiting factor for development initiatives (Lefore, Giordano, Ringler, & Barron, 2019; Njuki, Mapila, Zingore, & Delve, 2019; Theis, Lefore, Meinzen, & Elizabeth, 2018). As such, this study aims to investigate the role of farmers in agricultural development, conceptualizing them as ‘bottom-up’ innovators. This study aims to study how their knowledge and experience spread to wider populations through interactions and social learning, by performing a case study in the district of Catandica, central Mozambique. Central Mozambique is a particularly suitable area for such a study, because processes of farmer-led irrigation development have been shown to be a considerable driver of change for farmers there (Beekman et al., 2014; de Bont et al., 2019).

Due to such findings, farmer-led irrigation development, defined as “*smallholder irrigation that is initiated, operated, maintained and usually constructed by local people, using local materials and ideas*”, is receiving increasing attention in the past decade (Beekman et al., 2014). A growing body of literature indicates that small-scale farmers across sub-Saharan Africa (SSA) are developing irrigation systems and networks with minimum external assistance (Beekman et al., 2014; Bont, Komakech, &



Jan, 2019; Nkoka et al., 2014). While this is not a shocking statement, in development discourses this kind of development is often represented as backwards, inefficient and in need of external support to be legitimate and conducive to real change (Woodhouse et al., 2017). Irrigation development driven by smallholders is therefore neglected in mainstream policy arenas, despite evidence that such irrigation development is growing at a faster rate than that initiated by external actors (Beekman et al., 2014). Lankford (2009) shows that gravity-fed furrow irrigation in Tanzania enjoyed a sustained 4% expansion of “informal” irrigated areas over the decade of 1995 to 2005, for example. Beside this growth, data from countries like Niger and Nigeria show small and private irrigation systems to be contributing more than 50% to total irrigation expansion (Burney & Naylor, 2012; De Fraiture & Giordano, 2014). At the same time, many development agencies neglect these forms of development, with the FAO Aquastat database only measuring formally recognised irrigation areas, i.e. areas that have been ‘developed’ by external agencies (government, donors, NGOs), mainly those utilising “modernized” technology (Beekman et al., 2014). Against this background, governments, donors and other intervention agencies increasingly seek to support existing forms of irrigation practices in SSA, exploring interventions to build on them rather than discarding or neglecting them, and introducing new forms of irrigation technology and management in its place. The World Bank, for instance, is now actively promoting the concept of ‘farmer-led irrigation’ in SSA.

Designing new interventions to support processes of farmer-led irrigation development is not an easy task. The obvious risk is that external agencies, by means of the intervention, ‘take over’ the process of development or that external agencies continue to focus on the introduction of new, modern, science-based, irrigation and agricultural technologies. The World Bank, for instance, essentially uses the term ‘farmer-led irrigation’ to promote small-scale irrigation technologies in Africa such as treadle and solar pumps, and sprinkler and drip irrigation.

These tensions are also visible in the APSAN-Vale project, funded by the Dutch government and implemented by Resilience B.V., Future Water and HUB. This project aims to support farmer-led development as a means of improving water productivity and food security for climate resilient smallholder agriculture in the Zambezi valley of Mozambique. One of the main methods through which the project hopes to achieve this is through the identification of ‘model farmers’ in the local area and by conceptualizing some of the irrigation practices of these farmers as ‘innovations’, using some of the fields (*machambas*) of these exemplary farmers as demonstration plots. In this fashion, it is hoped that their practices/innovations will spread to other individuals in the area. This approach is guided by the finding that in areas where farmer-led processes of agricultural intensification have occurred, this can almost always be traced back to one farmer (APSAN-Vale, 2018). This farmer often functions as a source of inspiration (‘a model’) for other farmers in the area, who in turn, copy or take-over some of the practices of the ‘model’ farmer. This insight underscores the critical role of social learning in the process of knowledge transfer among farmers. To build on this phenomenon, it is therefore crucial to

understand the social dynamics that drive this kind of learning. How do these farmers ('innovators') come to learn about new practices, what characteristics distinguish them from others in the community and also, how are these innovations spread from one farm or plot to another? These dynamics cannot be explained by traditional, linear theories of knowledge transfer. As such, moving past modernist, technocratic approaches to development and trying to understand these social dynamics at the local level, presents a potential opportunity to design new development interventions based on farmer-led irrigation development.

Mozambique serves as a particularly interesting country in which to conduct research into the social dynamics which underpin processes of farmer-led development. The country suffers extremely high rates of rural poverty, where most of the population is reliant on agriculture (World Bank, 2016). Since independence, state led development to combat this poverty has been guided by high-modernist ideology that has been at the core of decolonisation thinking in Mozambique (Bont, Liebrand, et al., 2019). With the objective of commercialising perceived underperforming subsistence farmers to raise productivity and income, the state has pursued policy focused on external intervention and government administration. The promotion of market-orientated development of the agricultural sector is envisioned to transform rural populations. Understaffed and under-educated extension services have been unsuccessful in Mozambique however, with only 13% of the Mozambican population living in villages served by extension offices (Davis, 2008). Further evidence indicates that while state-led programmes can increase farm incomes, benefits tend to be concentrated in wealthier households with the access to assets or credit necessary to implement new technologies, while doing little to benefit poorer farmers (Cunguara & Moder, 2011). Through this process of elite capture, extension services have tended to exacerbate welfare disparities and actually increase inequality in rural areas (Davis, 2008). The state's struggle to support agricultural development since independence has also been punctuated by the civil war that ravaged the country, ending in the 1990s. As such, people practicing agriculture themselves, trying to improve their lives, has long been a dominant and recurrent mode of development in Mozambique.

1.2. Research Aim

This research aims to understand the dynamics which underpin farmer-led (irrigation) development in the context of central Mozambique, examining the spread of knowledge and resources related to given innovations. More specifically this research will try to understand the social dynamics which drive such processes and compare these with what key development actors perceive to be the drivers of innovation in agriculture.

2. Theoretical framework

2.1. Knowledge transfer

Traditional models of knowledge transfer are deeply embedded in modernization theories which were conceived during the colonial era. These linear models characterize the process of learning as the passing of knowledge from (western) scientists to extension services and finally on to farmers (Meijer, Catacutan, Ajayi, & Sileshi, 2015). This modernization perspective has played a prominent role in guiding and shaping agricultural development, underpinning the transfer of technology approach widely adopted by extension services in recent decades (Davis, 2008). This approach understands the key barrier to agricultural development to be the presence of knowledge in certain individuals, and its absence in others, with the schooling of the latter by the former as the solution. This dichotomous characterization of a highly complex process is found throughout the available literature on knowledge. Boateng (2006) distinguishes between the two types of knowledge; formal (also referred to as ‘scientific’ or ‘global’) and informal (also referred to as ‘tacit’ or ‘local’), summarizing that knowledge *“is said to be formal when it is based on scientific evidence, whose validity and reliability can be tested over a reasonable period of time. Informal knowledge, differently, is experiential in nature and is acquired after an exemplary practice has been put to use over a period of time”*. Similarly, Nonaka (1994) relied upon an analogous construction of knowledge when distinguishing between codified knowledge, which is highly transferable as a result of being formalized in some regard to facilitate sharing, and tacit knowledge, which is localized and acquired through personal experience. Guilhon (2001) understands the process of formalizing tacit knowledge to codified knowledge for use by others to be the key process of knowledge transfer. Others claim the failings of agricultural extension services in the past can partly be attributed to this process of trying to convert tacit knowledge to codified knowledge. In the process of trying to increase the applicability of local knowledge to make it communicable to broad populations, knowledge can become exceedingly general in nature. Then, rather than being beneficial to the masses, this knowledge becomes vague and difficult to implement for the majority of intended benefactors (Saito & Weidman, 1990).

Transitioning from this idea of knowledge as a universally applicable, scale and culturally neutral resource which is transferred from the ‘west to the rest’, knowledge transfer is increasingly coming to be understood as a social process composed of a wide variety of actors. Long (1996) puts forth the case for the constructivist perspective, an approach to knowledge transfer which takes full stock of the wide range of social actors that contribute to the developing of knowledge, encompassing a more holistic understanding of the concept. This approach was further expanded upon by van der Ploeg (2003) who claimed that more formal knowledge, as offered by the applied sciences, and standardized technologies, as supplied by agribusiness, require new forms of local knowledge for their application. As such, new, hybrid, specific knowledge of a localized character emerges. This melding of local and scientific forms of knowledge in a more comprehensive model of knowledge creation and transfer is aptly summarized



by Long (1996), who wrote that patterns of agricultural development are “*subject to the combined effects of globalisation and localisation: that is local institutions are transformed by becoming part of wider ‘global’ arenas and processes, while ‘global’ dimensions are made meaningful in relation to specific ‘local’ conditions and through the understandings and strategies of local actors*”. As such, the creation of knowledge by farmers implementing global knowledge at the local level, driven by social processes, gives rise to outcomes which are not consciously calculated or intended by individuals or organisations and cannot be accurately predicted. As such, the two forms of knowledge are not dichotomous states, as endorsed by earlier academics, but rather mutually dependent and reinforcing means of creating new forms of knowledge through various channels (Alavi & Leidner, 2001).

Knowledge transfer – in the broadest sense of the word – is therefore increasingly falling under the inquisitive gaze of social sciences, rather than remaining solely under the remit of natural sciences, as has been the case in the past. Understood as a social process in which various actors come together to share, implement and build upon each other’s knowledge to give rise to new and unexpected forms, the social dynamics which underpin these processes have come to be understood as one of the limiting factors to development, rather than technical limitations of new processes or technologies. In *A Theory of Access*, Ribot & Peluso (2003) underline the importance of social relations as a means of limiting access to resources like ‘knowledge’. Talking specifically about social identity, they explain that the distribution of benefits from a given resource is directly mediated by the membership of different social communities or groups based on characteristics such as age, gender, religion, status etc. In the discussion of the utilisation of social relations towards the access of a given resource, they explain that “*Access via the negotiation of other social relations of friendship, trust, reciprocity, patronage, dependence, and obligation form critical strands in access webs. Like identity, social relations are central to virtually all other elements of access*”.

2.2. Social learning

The term social learning describes the process by which an individual learns from his/her neighbours’ experience (their previous decisions and outcomes) in relation to a new technology (Munshi, 2004a). There is a wealth of empirical evidence in Africa as far back as the 1990s that show that farmers learn how to grow new crops or implement new technologies from others in their social network or wider community who have already done so (Besley & Case, 1994; Conley & Udry, 2008; Foster & Rosenzweig, 1995; Munshi, 2004a). Generally, these studies can be divided in two broad categories. One category of studies documents the spread or ‘adoption’ of new technology among farmers once it has been introduced by an external actor such as the government (high yield varieties, new seeds, irrigation technology etc.). These studies tend to remain faithful to dominant ideas of technology transfer; the analysis is often captured in terms of ‘adopters’ and ‘non-adopters’ and guided by a concept of ‘adoption’ that is associated with a change of practice according to particular pre-conceived ideas, i.e. the use of a new ‘technology’. The other category of studies documents the practices of farmers in



more general terms, studying how farmers cultivate their fields and create new forms of knowledge by means of trial-and-error, diffusion, and social interaction – and learning. In these types of studies, the meaning of ‘knowledge’, ‘technology’ and ‘learning’ is often explicitly debated (what counts as knowledge and what not; what is technology and what not etc.). The recent academic work on farmer-led irrigation development in Central Mozambique largely falls in the second category of studies.

An example of the first category of studies is Bandiera et al. (2006). This study investigates the relationship between the number of ‘adopters’ known to an individual and their likelihood to ‘adopt’ newly introduced sunflower seeds on their own farm. The study suggests that this relationship follows a certain type of linear inverse-U shape correlation. The authors pointed to this as evidence of complex dynamics at play in social learning, such that when many adopters are in a group, there is a greater incentive to adopt as there is a wealth of information available on the given practice, but simultaneously this can stimulate a strategic delay to freeride on the experimentation of others for a prolonged period to reduce own exposure to risk. More striking was the result from the same research that found adoption decisions are more correlated within family and friends than religion-based networks but wholly uncorrelated among individuals from different religions. Such research indicates the need for a knowledge of local norms and dynamics before intervention but also points to one of the main critiques of the method. This critique is the fact that researchers who apply it are forced to impose a particular boundary on the social network or peer group from which an individual is capable of drawing instruction, with it still falling within the boundary of ‘social learning’ (Miguel & Kremer, 2003). Should this be geographical, based on kinship or even religion as the above study indicates? Indeed, empirical research as that referenced above indicates these distinctions, extremely difficult to identify and delineate, can in fact have a massive bearing on social learning but are highly localised and cannot be extrapolated to regional or national levels or known before entering a community. Part of the problem also lies in the conceptualization of what technology is, and what is seen as adoption. Central to the theoretical foundations of such research remains the analytically identifiable and distinguishable populations of adopters and non-adopters, a modernist construction of social learning.

Munshi & Jacques (2002) took a critical lens to this theory and questioned what indeed constituted social learning, incorporating imitation based on more informal exposure to new practices or technologies through observing others into their model. As such, while built upon the foundations of social network theory, social learning expands upon the idea of a social network of known and connected individuals as described by Rose (1983). For social learning to occur, the individuals do not need to be directly known to one another or in direct face-to-face contact for this sharing of knowledge to occur. Individuals can transfer, implement and indeed create knowledge through observation and mimicry alone, making the concept broader and more encompassing. This kind of informal knowledge transfer is conducive to the creation of new localised types of knowledge as previously discussed. In the absence of formal tuition of one individual by another, imperfect imitation can lead to new, unintended practices as a result

of trial-and-error mimicry. This research therefore understands social learning to be the acquisition of knowledge through observation of the practices of individuals by a given farmer in addition to more formal modes of instruction between farmers.

2.3. Innovation

The available literature on innovation can also broadly be distinguished by those which subscribe to normative constructions of ideas such as ‘development’, ‘technology’ and ‘adoption’ and those which strive to transcend clearly delineable definitions of such concepts. Amongst the latter, many academics tackle the dichotomous characterization of ‘adopters’ and ‘non-adopters’ discussed above. Literature argues that the adoption of any innovation is a dynamic decision problem spanning at least several years. Over this period, farmers will experiment an innovation, be that through their own initiative or based upon their exposure to others who are implementing some form of innovation on their own land (Ghadim & Pannell, 1999). As such ‘innovation’ needs to be understood as a lengthy and constantly ongoing process rather than the binary implementation or non-implementation of some practice in a given season or even year. The very idea of a clearly definable ‘innovation’ has also been critiqued (Feder, Zilberman, & Just, 1985). External technological packages often include numerous components for example, and a given farmer may introduce certain components of the package or a subset of the package, leading to several less clear-cut adoption and diffusion processes of innovation occurring simultaneously.

More binary understandings of innovation can be traced back to the Diffusion of Innovations theory by Everett Rogers, originally published in 1957. Rogers (1957) defines innovation as “*an idea, practice or object that is perceived as new by an individual or group (or organisation)*”(Rogers, 1957). Fundamental to the theory is a bell curve graph which seeks to explain the rate of adoption of a given innovation in a population, with a list of correlated explanatory variables. Where an individual falls along the curves indicates that they are identifiable as one of five categories related to their propensity to adopt a given innovation, namely; Innovators (2.5% of population), Early Adopters (13.5%), Early Majority (34%), Late Majority (34%) and Laggards (16%). The theory has informed rural development programmes for decades with unsatisfactory results. Much like the failings of trickle-down economics, the focus on targeting the ‘innovators’ and ‘early adopters’ with the hope of these interventions disseminating into the wider community has served to advantage already more prosperous farmers, doing little for the poor and exacerbating inequality (Cunguara & Moder, 2011). Academic critiques argue the theory implicitly states that a given innovation is good for all and should be universally adopted, regardless of local context, to advance along the linear road towards a supposed development standard. The theory also paints innovation as a one-way process beginning exclusively in the western scientific community, with no input from farmers themselves (van den Ban & Hawkins, 1998).

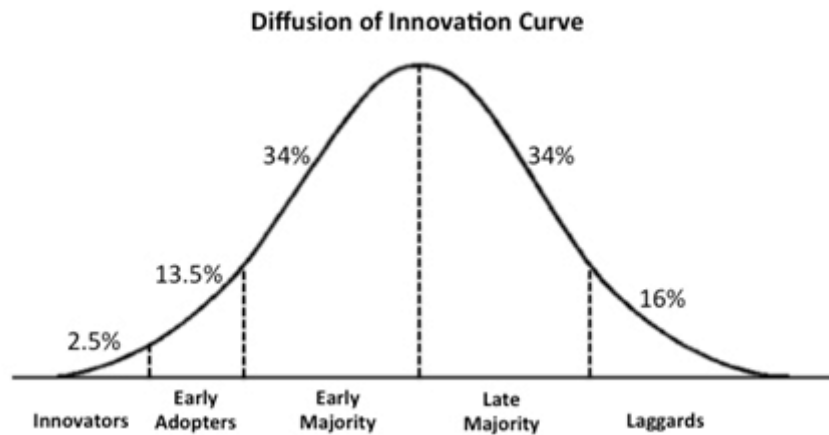


Figure 1: Diffusion of Innovation Curve (Rogers, 1957)

The low explanatory power of statistical models which are based upon this theory have forced academics to reconsider and critique the theory by expanding upon its core ideas (Ghadim & Pannell, 1999). One of the main critiques that has come about is aimed at the focus on the role of extrinsic characteristics of both the farmer (age, gender, household income etc.) and the technology itself (risk, potential benefits etc.) in explaining adoption (Meijer, Catacutan, Ajayi, & Sileshi, 2015). While literate, older and less vulnerable farmers are generally more likely to cultivate a new crop, this only goes part of the way to explaining why certain individuals are more likely to adopt innovations than others (Bandiera et al., 2006). As such, since the 1980's there has been a growing body of research which aims to transcend the mere characteristics of the potential adopter and the innovation and begin to consider more intrinsic factors (Meijer et al., 2015). This signifies a movement past the idea of a population of farmers as a homogenous mass towards understanding that populations are made up of individuals with different life experience which will guide their adoption choices. Meijer et al (2015) put forward an analytical model where transfer of knowledge is simply the first phase in the decision-making process, with the role of knowledge, perceptions and attitudes of farmers at the centre of the process which decides adoption.

Therefore, a more holistic understanding of innovation guides this research. Innovation is understood as the constant process of farmers experimenting to some greater or lesser degree as new information reaches them or as they try to solve new problems on their plots. In this sense, innovation is also spatially and temporally contextual, as what is innovative in one community at a given time, may be a widely used and solidly established practice in another community or in the same community at a later time.

2.4. Conceptual framework

The conceptual framework below illustrates some of the main points, themes and interactions discussed in the theoretical concepts above. More specifically it discusses the interactions of three hypothetical farmers following the provision of new knowledge to Farmer A from a given development intervention. Given their successes in implementing new technologies in the past, Farmer A begins experimenting with this knowledge on their farm. Given Farmer B is in the social network of farmer A, social learning occurs here as Farmer A instructs Farmer B in the new practice. Nonetheless, being less experienced

and with more dependents in their household, Farmer B postpones implementing the new technology as they deem the risk to be too high. At some point (when Farmer A begins to experience success with their innovation) through social learning, Farmer B will implement the same innovation on their own farm, building upon the knowledge of Farmer A. At this point, they will communicate the results of their experimentation to each other and continue to innovate together, transcending the content of the initial knowledge transfer. Farmer C is not in the social network of the other two farmers however, but observes the changes being made on Farm A as this farm is located along Farmer Cs route to the local market. At this point Farmer C begins to try and mimic these innovations with imperfect knowledge. These interactions lead to the development of new, localised knowledge which is unique from the original knowledge transferred in that it has been tailored by local actors to suit their personal needs and the environment into which it has been introduced. This new knowledge is then internalised by the originators of the knowledge, APSAN Vale, and can be used to guide future projects.

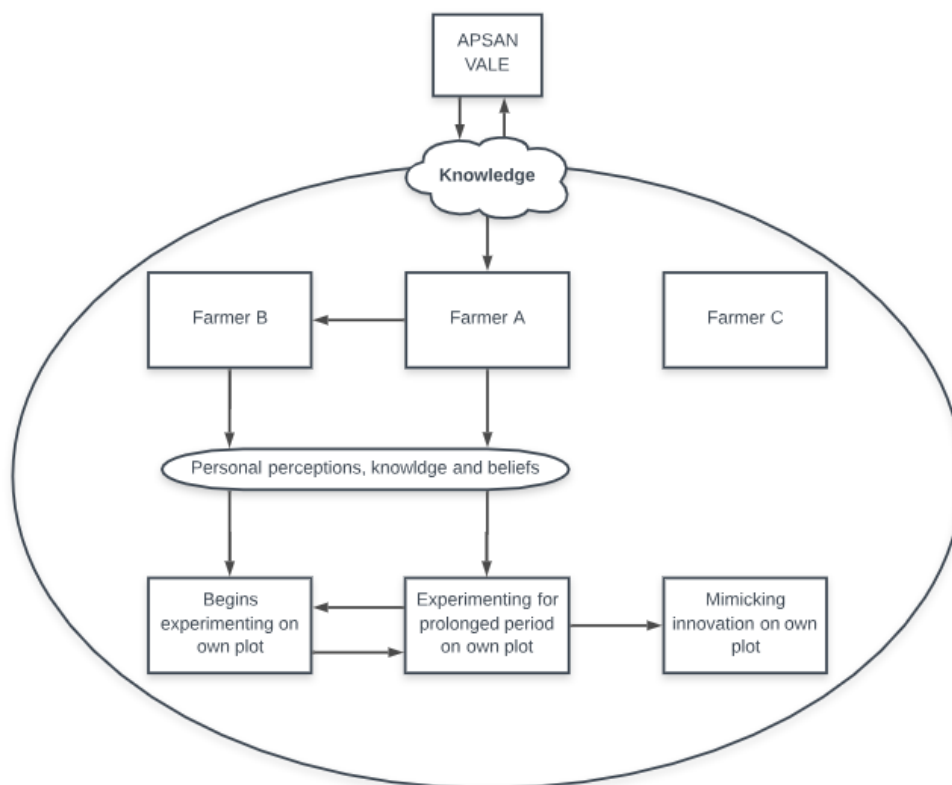


Figure 2: Conceptual framework of agricultural knowledge transfer in rural community

2.5. Knowledge gap

There is a wealth of literature to date on processes of knowledge transfer, social learning and innovation. Contemporary literature refutes the notion that the spread of innovation is attributable to the extrinsic characteristics of either innovation or farmer. With a growing understanding of the importance of social learning in processes of knowledge transfer, understanding the often highly localized and specific channels through which knowledge spreads is critical in project design. Empirical data on these specific



channels in central Mozambique focuses on who does share and receive knowledge and is generally considered ‘innovative’, rather than those who tend to be excluded from such processes of development.

2.6. Research question

How does innovation spread in farmer-led processes of (irrigation) development in central Mozambique?

1. Which innovations are currently being reproduced through farmer-led processes of development and how are they organized?
2. How are knowledge and resources related to these innovations transmitted from one farmer to another and, more broadly, what characterises this spread throughout communities as a whole?
3. How do key development actors distinguish ‘innovative’ farmers from their peers?
4. What characteristics are found to actually distinguish farmers who engage with this innovations from those who do not, and what boundaries face the latter?

3. Methodology

In this chapter, the methodology employed to conduct this research is discussed, beginning with an introduction to the host organisation and the approach adopted, followed by a more specific outline of the sampling strategy, data collection and analysis. To conclude, ethical considerations associated with the research are discussed as are the limitations of the methodology.

3.1. Host organisation

This research was hosted by Resilience - a Dutch company that specializes in agriculture and water research, paying specific attention to farmer-led irrigation development (Resilience BV, n.d.). Resilience are currently active in the research site of Inhazonia through the APSAN-Vale project, which aims to increase food and nutritional security through supporting bottom-up agricultural development processes. Further assistance was provided by the staff of project partner HUB, who have a field office in the District capital of Catandica, my home during the course of this research. Besides logistical assistance, the knowledge of Inhazonia and links to the local community proved invaluable, especially in establishing initial contact with community leaders. In this role as gatekeeper to the community, HUB staff also facilitated my pairing with local farmer Sebastião who served as my guide and translator. In addition to translating in both Portuguese and local dialect Chibárue, Sebastião's personal knowledge of farming and indeed farmers in the area helped greatly with contextualizing data and recruiting participants.

This research aims to support the work of Resilience and HUB in the area of Inhazonia, but also the APSAN-Vale project as a whole. Through illuminating the manner in which farmers share and create knowledge in the absence of external guidance, it is hoped that the project can support this kind of farmer-led development in the future.

3.2. Research approach

The objective of this research was to understand the social dynamics which underpin processes of knowledge transfer in farmer-led innovation, with a focus on farmer-led irrigation development. I adopted an ethnographic approach to this research as I wanted to understand what these processes look like from “below”, for the farmers themselves. This form of qualitative research has its roots in anthropology and is of particular use when examining human, interpersonal, social and cultural processes. I set out to understand the spread of innovation not as a phenomenon of technology, but rather a cultural and societal one and felt this approach would be best suited. Ethnographic research requires prolonged and in-depth periods of investigation within the community of interest. Investing time in the research area as such allows you to gain insights into revealing behaviours and norms, ways of life, social interactions and perceptions of the people which can be otherwise difficult to observe. To further enhance the emic perspective which would be gleaned through this approach, participatory methods were used when interviewing participants. Using participatory methods was particularly fruitful in this research due to my relative inexperience in agriculture. Through allowing the farmers to explain their



practices, lifestyles and problems, rather than simply probing them with prewritten questions, I was introduced to pertinent new ideas and concepts that would have otherwise evaded my attention.

While the initial approach to this research was a broad analysis of the spread of innovations in the area more generally, during fieldwork the focus was honed to a case study specifically examining the spread of irrigated litchi production (ILP) in Inhazonia. This decision was based on preliminary findings which indicated that this innovation was making considerable contributions to the development of local smallholder farmers in a fashion that was notably farmer-led in its nature. Another consideration that informed decision was the belief that an in-depth case study of a delineated set of innovations would be more insightful and beneficial than trying to map the countless innovations simultaneously occurring in the community.

3.3. Data collection

The data which informs this thesis was collected using mixed methods over a four-month period between February and June 2019. The first phase of this work consisted of desk research conducted at Utrecht University, in the Netherlands, before collecting the majority of the data over a period of three months in Mozambique. This interval in the field spanned March to June and coincided with the conclusion of the rainy season and the concomitant transition to irrigated agriculture. This proved particularly beneficial for my research as irrigated agriculture tends to exhibit higher levels of innovation than dry season agriculture, with a greater variety evident in both the types of crops grown and the methods used in their production.

The focus of my desk research was on theories and concepts related to innovation in agriculture, contextual information about society in Mozambique and practical papers which served to furnish the suite of methods I later employed in the field. During this period of initial preparation, I benefitted greatly from meetings with Resilience staff and my thesis supervisor. This period of desk research and consultation culminated in the submission of my research proposal prior to departure for Mozambique in March.

Arriving in Mozambique, I spent some days in the capital, Maputo, where I met with representatives from Resilience and the Dutch embassy to gather information about Mozambique and their operations in the research area. Following this period of meetings in the capital I then travelled to Chimoio for further meetings with Resilience staff at their field office there, the headquarters for the APSAN-Vale project. What was intended to be a brief sojourn in the provincial capital of Manica before travelling to the research area was prolonged by the arrival of cyclone Idai. The natural disaster which devastated Mozambique and neighbouring countries delayed arrival in the research area by two weeks, after which I collected most of my data during a two-month period in the Localidade of Inhazonia.

With Sebastião's assistance, a community meeting was arranged through the local leader which served as an opportunity to introduce myself and my research to members of the local community. Following

this introduction and some questions, I conducted a focus group where we discussed the agricultural calendar and what crops were popular in the area. Following this initial meeting, the bulk of my research consisted of semi-structured interviews with farmers. First-time interviews with farmers were always held at their farm. This afforded me the opportunity to directly observe what innovations they were practicing on their land and allowed the farmers to tell me about their practices in the casual setting of their own farm. All interviews were conducted with the assistance of Sebastião. After greeting the farmer and the necessary formalities, we first conducted a transect walk where the farmer was asked to identify the different crops they were growing and briefly explain the main practices they employed on their land. During semi-structured interviews after these transect walks I asked more specific questions about crops or practices which had been identified and more general questions pertaining to the farmers themselves. I conducted follow up interviews with specific farmers where clarification was needed in relation to some previously collected data or the farmers were of particular interest in terms of this research.

Outside of conducting these interviews, I spent prolonged periods of time in the research community, in line with the ethnographic approach. Besides the more formal interviews held in the manner described above, I had informal conversations with participants and members of the wider community in a variety of settings, commonly while eating or drinking. In addition to these daily occurrences I also spent time weeding and sowing in the fields of certain participants and accompanying them on journeys to the market to sell their produce. While these interactions proved valuable for me in a non-academic sense, they were also extremely beneficial to my research. Firstly, they served as a means of building rapport both with my translator and members of the community. Secondly, the more informal setting allowed people to speak more freely and discuss matters that would not arise in the more formal setting of interviews or



Photograph 1: Enjoying some sugarcane with local children following an interview (author's own)

have been addressed by my line of questioning. Thirdly, these opportunities allowed me to observe what people spoke about in their own time, their hopes and concerns both related to agriculture and more broadly. I managed to gain a deeper and broader understanding of the lives of people in Inhazonia which furthered my of my research and revealed more about the context in which it sits.

Interviews with key informants in the area also served to further my understanding of the agricultural, social and political dynamics of Inhazonia and, more broadly, the District and Province. These

individuals represented the public, private and non-governmental sectors and a diverse range of areas of expertise and general perspective on innovation and development in agriculture. They are summarised below in Table X.

Table 1. List of informants interviewed as part of this research

Informant	Position	Organisation	Focus of discussion
Lucas Josefa Raice	Director of Agriculture	Servicios Distritais de Actividades Económicas (SDAE) Bárue	Government approach to agricultural development and current initiatives
Feliziano Constantino Chicoche	Supervisor of Agriculture	SDAE Bárue	Demographic information of area and agriculture
Peter Waziweyi and Elisabeth Sikoya	Advisor and General Manager, respectively	Nzara Yapera	Agricultural development in Inhazonia, history and current operations of Nzara Yapera
João Gomes	Extension Worker on APSAN-Vale project	HUB	Selection of participants for project and modes of project evaluation

3.4. Data management and analysis

During the course of this research extensive field notes were kept in a notebook. When conducting interviews with participants I recorded answers to questions and later transcribed them. Pertinent pieces of information collected during more casual encounters were also recorded in this fashion, along with more general observations made while in the field. Interviews were codified and a small summary of main ideas and concepts was compiled for each, allowing for connections and trends between interviews to be more easily recognised. Towards the latter stage of this research these connections and common threads were more formally summarised and integrated into further interviews, with the objective of reaching the point of saturation whereby answers to specific questions relating to how farmers accessed given innovations were predictable to a high degree. As such, data was triangulated in follow up interviews. Upon returning to the Netherlands, typed interview notes and summaries were further codified and analysed with respect to answering the research questions.

3.5. Sampling of respondents

Snowball sampling was selected for this research due to its applicability and suitability when networks are the focus of attention (Coleman, 1958). When snowball sampling, the researcher initially samples some group of individuals relevant to the research question and then further samples participants who are proposed by the initial sample as having a desired characteristic. For this research, I recruited my



initial sample at the community meeting described above, appealing for farmers who practiced agriculture in the area and would be willing to be interviewed as part of my study. From this initial meeting we collected many willing participants and visited a small selection which, through the insider knowledge of Sebastião, were identified as representing a broad range of genders, ages and general prosperity levels (based off land holdings and income). Further participants were contacted after being identified in these initial interviews as a source of knowledge about a given innovation which that farmer practiced or planned to implement in the future. Sampling in this fashion I began to map the spread of a group of innovations, such as use of water for irrigation, through the local community.

While pursuing these avenues of investigation, I continued to sample individuals from our initial sample. After two weeks however, the additional criterion of ‘must operate irrigated agriculture in a *horta*’ was applied as a prerequisite for all participants as I came to gain a greater understanding of agriculture in the area. This decision was taken as I realised that irrigation is not employed in *machambas* and that *hortas* generally exhibit higher levels of innovation, while many farmers use the same methods to grow corn every year in their *machamba*. In the third week of my research I decided to further hone my focus and follow the spread of a specific group of innovations in the area of Inhazonia, namely those which pertained to the practice of ILP.

At this point I therefore further refined the criterion employed when filtering the acquaintances of interviewees for further participants. These were a) people who were identified as helping the participant access *shartia*¹ or knowledge about growing litchi, b) people who were identified as helping the participant to implement irrigation and c) any acquaintance who was practicing ILP in the area or aspiring to do so in the near future. In addition to pursuing these avenues of investigation which focused on litchi growers, at this latter stage of my research I also continued to interview individuals from the wider community and those individuals who had come forward at the initial community meeting. This served as a means to understand the barriers which these farmers faced in terms of trying to engage with the expanding practice of ILP in the area.

I interviewed a total of 21 farmers and 4 key informants. Of the group of farmers, 15 were practicing some degree of ILP at the time, 14 of the participants were male and 7 were female. Within this sample of participants there were individuals from a broad range of socioeconomic classes, marital statuses and ages. As such the emic perspectives of a wide range of individuals, representing various sub-groups within Inhazonian society, were accessed. This afforded me a wide range of perspectives, illuminating the varying barriers different individuals face in terms of accessing such innovations, based on their place within Mozambican society.

¹ A form of sapling used to grow litchis in the area. For further description please see Section 4.2.

Dara from the 2017 Demographic Census for the District of Bárue gives an indication of the representativeness of this sample. According to this census, average agricultural land holding per family is two hectares and 60% of farmers are women. The average family size is six and average age 43. Comparing this against the sample of farmers interviewed as a part of this research, men are over-represented in this sample, as are farmers with above-average land holdings. Household sizes and ages across participants are more representative of the wider community².

3.6. Ethical considerations

This research was conducted in accordance with the ethical guidelines outlined by Hennick, Hutter, & Bailey (2011). While ethical considerations are always important when designing and conducting research, such considerations are particularly pertinent when performing ethnographic research. At the core of such research is integrating into the community of interest, becoming acquainted with local people and forming relationships with them. Working so closely with people presents additional opportunities to offend or mistreat a participant or use them in an immoral manner for the purpose of your research, due to the more intimate relationship. I always tried to be respectful towards respondents and members of the wider community and made efforts to familiarise myself with and respect local tradition and customs to do so. I was also conscious of not abusing the trust or kindness of individuals and not misleading people about my intentions in an effort to extract data.

Beyond this being an issue due to the ethnographic approach I adopted, this was also an issue due to the history of development projects in the area. Due to this long history, many people in Inhazonia instantly associate ‘white people’ with development projects and the potential to benefit from such interventions. I made my position as a researcher clear at my first introduction to the community and prior to every interview. In introducing myself I made explicit that I was not here representing a development organisation or project and would not be distributing any form of aid to the local area. Even still, occasionally after an interview, a participant would enquire as to what they could expect in the future or how I would see to it that they were considered for the next project to pass through the area. In these cases I would explain that my research would be fed back to the host organisation and hopefully see the hopes and concerns of local people feature more in the planning of project design.

When conducting my research I also sought to make the whole process a two-way conversation as much as possible, rather than simply arriving into the community and mining data from local people to my own end. As such, when conducting interviews I introduced participatory approaches and tried to truly understand the perspectives of participants, rather than rattling through answers to a set of prearranged questions. In time spent in the community more broadly I also sought to understand the opinions of people, even when they heavily contradicted my own world view, and respect alternative views and

² Census data is from formal communication with Feliziano Constintino Chicoche (see Table 1)



values, rather than reacting in a hostile or patronising manner, coming from a place of perceived authority, as can sometimes occur when researchers arrive at such places.

Real names are used throughout this thesis as informed consent was given by study participants who were informed that data provided would be compiled in a written thesis.

3.7. Limitations

In deciding to conduct a case study on ILP in Inhazonia, there are limitations inherent in this research. As described by Lund (2014), a case is not naturally occurring but is rather a mental and analytical construct which helps us to process and organise knowledge about empirical reality. To do this, it is necessary to focus on certain features of a society or phenomenon and allow others to diminish in importance. In defining criteria for my participants and honing in on such a specific group, the generalisability of my findings are naturally limited. By choosing to focus on this phenomenon through ethnographic observation the findings are highly concrete in addition to so specific. This research therefore contributes empirical evidence relating to theories of innovation specifically rather than further developing such theories in an abstract fashion and becomes more generalisable through balancing with complementary evidence from similar studies.

Employing purposeful sampling through snowballing also has implications for the representativeness of this research. I made an effort to include participants which represented different strata of Inhazonian society with considerations for socioeconomic classes, genders and ages amongst others. I also made a concerted effort to interview farmers living in the area who were not yet engaged with ILP and understand the perspective of these individuals. Even so, while trying to factor in the heterogeneity of the research community, by choosing to primarily focus on one group of innovations and, at that, a quite an exclusionary group of innovations, the representativeness of the sample is limited. What has been a successful route to development for those farmers who partook in my study may not be a viable option for the majority, as certainly seems the case based on the level of political and social connectedness observed in the growers. Furthermore, the findings of this research are positioned within the highly localised context of Inhazonia, with its history of development projects, prominent agricultural actors and water abundance amongst other factors. As such, the applicability of my findings to other communities is also limited.

While I adopted an ethnographic approach and ventured to gain an understanding of the local people and their perspective on ILP and their personal opinions, this perspective has subject to various barriers and biases. Primarily, the voice of the community as I experienced it was filtered through the lens of my translator who is himself a farmer with a history in development projects, litchi growing and indeed the participants we spoke to. His worldview and perceptions invariably coloured the voice of the community and people I spoke to. Furthermore, while I felt confident in his abilities to translate, it is natural that some of the more nuanced points farmers tried to express will have been lost in translation. As such, for



pertinent questions of points of particular interest to this research, I made a conscious effort to probe issues through asking questions in multiple ways for clarification yet on some occasions, there were points where trains of conversation could not be explored further due to language barriers and being conscious of taking up participants time.

While objective research is always the standard scientists set for themselves I am keenly aware that my own perceptions and worldviews will have coloured how I interpreted what I was told and heard while conducting my research and how I formulate data into coherent findings. Researcher bias will have impacted my research as early as the design stage and limited the degree to which I can truly understand the perspective of people who exist within a totally different society from that which I have grown up and have totally different culture.

Finally, having a weak affiliation with the APSAN-Vale project presents a threat to the authenticity of some answers given by respondents. There is a long history of development projects in Inhazonia and some residents there are au fait with the language of such projects and understand the processes by which they select benefactors. At community meetings and prior to every interview, I explicitly stated my role as an independent researcher, distinct from the APSAN-Vale project and explained I would not be providing any resources. All the same, there is a concern that some farmers may still have optimistically seen the interview as an opportunity to access a new development project in the area and tailored their answers to meet expectations they prescribed to me. Respondent bias may also have been influenced by the presence of my translator, a man known to many of my respondents and who is politically active in a nearby village.



4. Research area

4.1. Inhazonia

4.1.1. Geography

The District of Bárue is one of ten Districts which make up Manica Province, central Mozambique. Government population predications indicate the 2019 population to be in the range of 282,000 people. Geographically, the District is limited to the north and south by the Mupa and Púngue rivers respectively, and to the west the Chôa mountain range (referred to as the Sierra Chôa locally) serves as a natural barrier between Bárue and Zimbabwe. The climate across the District is predominantly tropical rainy savannah with average annual max/mins ranging from 28.8 degrees celcius to as low as 15.7 and average annual precipitation in the range of 1,600mm. There is a distinct wet and dry season, and in these conditions agriculture in the dry season is reliant on access to water and irrigation. The District capital of Catandica is the only urbanized village within the area and the population is otherwise spread across 161 rural villages.

12km from this urbanized capital and lying at the centre of the District is the Localidade of Inhazonia, home to approximately 25,000 people. The Localidade of Inhazonia is further broken down into five communities, with Mutangadzi serving as the focus of this research, home to 2,000 people. While agricultural land is available in and around the village of Mutangadzi, it is predominantly a residential area with some small shops (bancas) and a local market for fresh produce. Many of the residents of Mutangadzi have land which they farm in the nearby villages of Nhamazao, Nhamuzarara I and Nhamuzarara II. In addition to the relative abundance of land in these areas, they are also favoured for their proximity to the Sierra Chôa, meaning they are served by numerous rivers which run down from the mountains. Residents of Mutangadzi sometimes also have dwellings in these areas where they can sleep during periods of intense work. This serves to eliminate the daily commute of 1 to 4 hours walking each way, between home and field, depending on the location of their land.

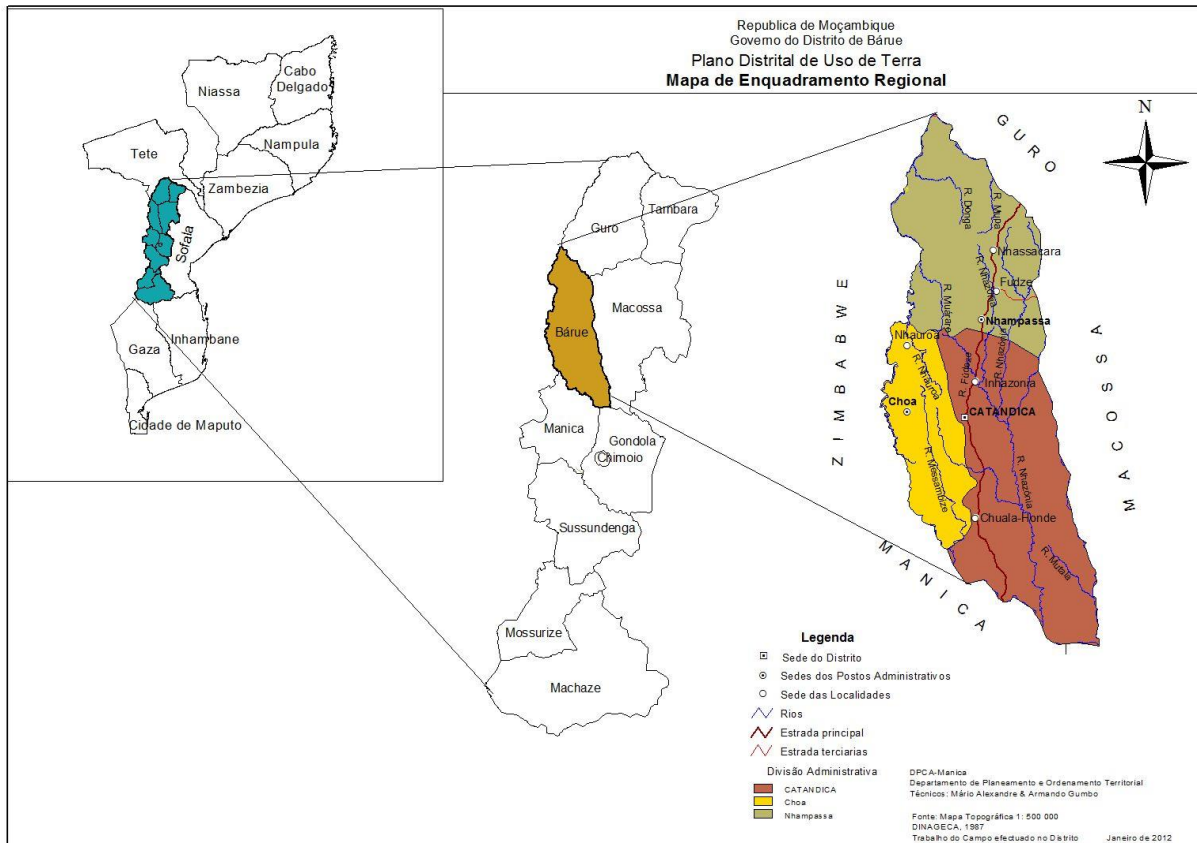


Figure 3: Map of the District of Bárue (Governo do Distrito de Bárue, 2019)

4.1.2. Political context

As throughout all of Mozambique, politics is a contentious and enigmatic issue in Inhazonia. While the inner political leanings of citizens are rarely discussed freely and openly, party allegiances are of utmost importance in Mozambique. As such, when performing sociological research, politics are a vital component of everyday life to understand. Within the research area, there is ubiquitous support for *Frente de Libertação de Moçambique* (FRELIMO), the country's ruling party since independence. While myriad factors contribute to the widespread support for FRELIMO in the area, there are some considerable contributors.

The first of these reasons is the firm monopoly FRELIMO has managed to establish over access to donors, internal networks and job opportunities in an aid-dependent, relatively resource poor country with a dearth of employment opportunities. As such, the party serves as a gatekeeper to opportunities for many Mozambicans and a crucial means of climbing social ladders. During the early post-independence period there was little distinction between the FRELIMO party and the Mozambican state (Sumich, 2010). While FRELIMO has made moves to separate the two institutions, civil servants continue to be members of FRELIMO as a matter of course. The rewarding of individuals who fought on behalf of the party during the independence struggle and civil war with roles in government is common practice. This kind of relationship between ruling parties and African states has traditionally been of keen interest to academics, particularly in relation to the capacity of such arrangements to create



a ‘national bourgeoisie’ (Cohen, 1982). This is certainly the case in Mozambique, where increasingly the party does not represent certain social strata but is a social stratum in and of itself, with party members having access to opportunities and power not accessible to ‘outsiders’ (Sumich, 2010). The proximity of Catandica, district capital and location of various local government institutions, serves to reinforce the power FRELIMO exerts over the local population and tantalise motivated individuals with the potential of ‘lucrative’ government employment.

Within the Localidade of Inhazonia itself there is also considerable benefit to be achieved from being an active and committed member of the party. Reforms to bring about democratic decentralization in the post-war era included a system of elected local governments but only made provision for thirty-three urban municipalities, wholly neglecting rural areas (Buur & Kyed, 2006). In 2000 the government instituted a Decree which formally acknowledged the different forms of rural leadership which had been disregarded since independence. Decree 15/2000 enlists those chiefs (previously tarred as colonialist colluders) as both assistants of the state and representatives of rural communities. Among their tasks and responsibilities are justice enforcement, land allocation, rural development, preventing crime and epidemics and other social matters (Buur & Kyed, 2006). As exemplified by benefactors of land within the community of Mutangadzi, it is prudent to ensure a cordial relationship with such individuals as a means of accessing valuable assets. The role of the party as brokers of development aid is also not to be understated. As explained by one farmer attending a party meeting providing information on registration for upcoming elections; *“I am not interested in politics, but it is important for me to be here, for people to know my face. I need help and want to be involved when the next project comes through”*. As a result of their control over access to opportunities for individuals, it is therefore unwise, if not foolish, to openly support or even discuss the prospects of the opposition, *Resistência Nacional Moçambicana* (RENAMO). People understand government ‘spies’ to be omnipresent, a tradition which goes back to the early days of Mozambican socialism when *“the government had one spy per every ten houses, which was necessary to keep the newly founded state under control”* according to one local professional in Catandica.

Another considerable contributor to FRELIMO support in the area is the concentration of individuals who were relocated to the area during the civil war. During this period of dangerous conflict, vast swathes of the country were subject to guerrilla attacks by RENAMO rebels. At one point the government had lost control of around 80% of the country's territory and the area under their control become effectively restricted to major cities (Sumich & Honwana, 2007). As such, relocation of communities from more rural areas to more concentrated and urban areas by the government facilitated their protection. Many residents in Inhazonia began their lives in the area as a result of such migration when they were relocated as war refugees. The community of Makosa was originally founded by a cohort of refugees who hailed from a rural area with the same name, and named the local area after their abandoned village. With the trauma of the recent civil war and the protection afforded to them by



FRELIMO (albeit through a forced migration to a previously unknown area), support for the party is understandable and to be expected, despite the grievances others would level against the party. These grievances range from corruption and nepotism at a local level, to the manipulation of election results on the national scale with certain individuals firmly believing that should the government truthfully report election results that RENAMO would hold the majority in parliament.

Politics is of the utmost importance in Mozambique, where the concept of the government, FRELIMO and the state itself have become melded in the minds of many to be a single, omnipotent force. Some see this as a benevolent force which is bringing about real change in the country, some see it as an oppressive and controlling force, which manipulates its power to serve the small elite. Regardless of an individual's opinion on the party, politics is accepted as an important means of accessing opportunities in Mozambique. The area in which this research was conducted is no exception in this regard.

4.1.3. Agriculture

Agriculture in Inhazonia is predominantly smallscale and, in many ways, reflects the nature of agriculture across most of Mozambique, where smallscale farmers account for 95% of the country's production (FAO, 2019). Average land size for agricultural production per family is 2 hectares, with an emphasis on the local staple of maize³. With the notable exception of some larger, commercial producers in the area the use of improved inputs such as fertilizers and pesticides are extremely low. The same is true for advanced technologies, with even the use of oxen to plough land a rarity and considered something for more affluent farmers. As such, agricultural production is both labour intensive and time consuming. Smallholders face a range of issues pertaining to climatic variation and access to markets and credit. The precarious situation in which farmers find themselves is confounded by government policies which neglect their needs and under resourced extension services. Two distinct phases comprise the agricultural calendar in Inhazonia, dry season and rainy season agriculture. While there is some overlap in terms of what crops are grown in each of these two phases of the year, there are clear distinctions to be drawn between rainy season agriculture, practiced on plots called *machambas*, and dry season agriculture, practiced on plots called *hortas*.

The rainy season generally spans November to March, with variations of a month on either end common. *Machambas* are usually cleared in September to prepare for cultivation, with the preferred methods of clearing as burning. Farmers with plots adjacent to one another commonly agree upon a fixed date to collectively burn the land, meaning more individuals are on hand to control the spread of the collective fire. This is a necessary precaution with many farmers in the area reporting losing crops or property in the past when such fires have gotten out of hand. *Machambas* are predominantly used to grow maize, and intercropping of other crops such as cucumber, groundnuts, pumpkin common. A more extensive

³ Information from from formal communication with Feliziano Constintino Chicoche (see Table 1)

list of common rain-fed crops is found in Table X below. While inputs are generally low in Inhazonian agriculture, this is especially true for rainfed production, which exhibits little to no input use for the vast majority of farmers. Produce from the *machamba is* generally designated for household consumption as maize flour is used to produce the local favourite, ncima, a type of thick porridge, although some farmers sell excess beyond the needs of the household. Maize is usually left to dry in the fields for two months before harvest in June. Farmers prefer *machambas* located close to roads which facilitate the transport of cumbersome maize harvests at this time of year.

Table 2: Lists of common rain-fed and irrigated crops in Inhazonia

Rain-fed crops	Irrigated crops
Maize	Tomatoes
Pearl Millet	Onions
Cassava	Collard Greens
Groundnuts (peanuts)	Lettuce
Sorghum	Cabbage
Sweet Potato	Carrots
Pigeon Beans	Cow pea
Sesame	Sugar Cane
Soy	Banana
Taro root	Avocado
Pumpkin	Orange
Okra	Lemon
Cucumber	Litchi
	Tangerine
	Mango

While most farmers practice rainy season agriculture which provides the staple foodstuff, maize, not all farmers practice dry season agriculture. Cultivating an *horta* requires greater investments in terms of both capital and labour and therefore is more commercially oriented than production in *machambas*. Production in the dry season is predicated on access to irrigation and farmers therefore prefer to locate *hortas* close to rivers and at the base of shallow inclines, both of which favour access to water. While *hortas* could be operated throughout the year, reliant on suitable combinations of irrigation and precipitation depending on the season, due to the intense workload associated with their cultivation, most farmers opt to only open their *horta* outside of the rainy season, opening around April and closing around August. Crops commonly found in *hortas* are listed above, mainly consisting of fruits and vegetables. Each households sells and retains different ratios of each different crop, with fruit trees being considered the most lucrative (and water intensive) crops.

Contract farming is prevalent in the area through two main companies; ECA and Samora Machel. ECA is a maize purchaser run by a Zimbabwean couple which sells locally produced maize both domestically and abroad, with a considerable market in South Africa. Farmers are offered different packages which range from ECA providing solely maize seeds to more expensive packages where fertilizer and other

inputs are supplied. The initial cost of the selected package is discounted from the farmers yield at the end of the growing season. Samora Machel offers similar services but specializes in the purchasing of soy beans. They are a homegrown company but are less commercially active than ECA.

As across all of Mozambique, extension services in the area are heavily understaffed and under resourced, with only one extensionista serving the whole population of Inhazonia. Across the District of Barue more broadly there are only 16 technicians at SDAE for 27, 470 people; a ratio of 1:1700 rather than the recommended 1:300⁴. The three main focuses of the extension services in the area are etc. The three main ways in 1. The conservation of agriculture 2. Mechanization of agriculture (with 20 tractors) and 3. Using improved seeds and teaching people how to plant them. Farmers who contact District Services for Economic Activities (SDAE) frequently get no response and for those who do receive site visits, it was commonly reported that little more than seeds were provided.

4.1.4. Socioeconomic context

Society in Inhazonia can be conceived as ‘traditional’ and ‘rural’ in its nature. Beliefs about gender and family dynamics coupled with the dearth of modern technologies and economic opportunities are more aligned towards what would be academically constructed as the ‘past’ rather than ‘modern society’. Many of the socioeconomic characteristics of the area and struggles faced the people who live there are analogous to much of rural Mozambique. Despite annual economic growth of about 7% between 1994 and 2010, there is alarming rates of rural poverty across the country stemming from deeply entrenched inequality. Levels of education in the area are low, attributable to a combination of social norms and the failings of the state education system.

One of the most significant aspects of life in Inhazonia is the paucity of employment opportunities outside of agriculture, which is generally subsistence or smallholder in its nature. This is quite representative of trends across the country where a meagre 5% of the populace has managed to eke out employment in the underdeveloped secondary and tertiary sectors. As discussed under section 4.1.2., this means that securing a position in local government, often through the utilisation of personal ties, is the only means of escaping primary production. Within Inhazonia, some people manage to diversify their income streams through running local bancas or the purchasing of produce from nearby villages, unavailable or sparse in their own village, to turn a profit. One form of secondary industry which is present in the area is the production of fermented alcoholic drinks from from sugar cane, sorghum or or maize. Within Mutangadzi there is an established rota of households who take turns producing 60 litre drums of nipa and then open their house to the public, selling this product, until the batch is complete, at which point the next house assumes the role of local tavern.

⁴ Statistic from formal communication with Lucas Josefa Raice (see table 1)

This lack of economic opportunity, coupled with the country's violent history, has resulted in a high degree of immigration across the border to nearby Zimbabwe, just across the Sierra Chôa. While Mozambican refugees in Zimbabwe can sometimes struggle to find spouses across the border, themselves being considered 'dirty' or 'poor', some do find husbands and wives with whom they eventually return to Inhazonia. This, coupled with Zimbabwe's own tumultuous history of



Photograph 2: Local farmer, Crecencia preparing alcoholic drink in drums using sorghum and bananas (author's own)

colonial oppression under British rule, means that there are also a large number of Zimbabweans residing in the area. As such, in addition to the local dialect of Chibárue, the Zimbabwean dialect spoken directly over the border, Shona, is also common in Inhazonia.

Data for the district of Bárue indicate that average household size is six persons. Customary marriages are the most common type in the area, with men paying a bride price (*lobola*) to the family of their spouse-to-be. While the legal age of marriage is 16 and 14 for men and women respectively, there are many cases of girls becoming brides much younger (Arnaldo, 2003; Roby, Lambert, & Lambert, 2009). Mozambique places second within the sub-Saharan region in terms of the incidence of child marriage and, especially for women, those who marry younger are more likely to come from a poor family and remain in poverty. Gender norms within the household are traditional in that women are tasked with cooking and cleaning, while men are considered the 'breadwinners' and work in the field. It is common for men to be expected to start assisting on family farms from as young as 8 or 9, at which point less energy is devoted to education. Between the frequency of child brides and male agricultural work from a young age, few people in the area complete primary education. Cessation of education also sees the end of people's tuition in Portuguese, resulting in certain farmers, especially women, often being restricted to their local dialect. This trend has also been influenced by the country's violent history which disrupted lives and forced migration, making consistent school attendance problematic. Both monogamy and polygamy are practiced in Inhazonia and patrimonial heritage is customary. As such, accessing land through marriage is common amongst women⁵.

⁵ Findings of unpublished thesis by Isabella Schultz, Utrecht University, who conducted field research in Inhazonia alongside this research in 2019

4.2. Practices and innovations of litchi production

Litchi (*Litchi chinensis* Sonn.) is the most popular member of the Sapindaceae family while originating around southern China/northern Vietnam, is now cultivated internationally. While the crop favours subtropical climates, it grows well in the tropics at altitude and in a great variety of soils (Menzel, 2001). The sweet, pink fruits which the plant produces are becoming increasingly popular in Europe and therefore present an opportunity for smallholders to profit from export-oriented production of this lucrative cash crop. This process has been facilitated in Inhazonia by the presence of Westfalia Fruit, a multinational supplier of fruit and vegetables, providing access to the foreign market. As such, litchi production in the area has been expanding over the past decade in conjunction with farmer-led irrigation development. Expanding litchi production in the area has been reliant on a concomitant expansion of irrigation as the trees are extremely water intensive. Rainfed fruits are generally small, bitter and of an unacceptable quality for export to the European market. While precipitation during the rainy season is sufficient to support the plants, throughout the dry season and into harvest, with each tree consuming 50 – 60 litres a day, irrigation is a prerequisite for a good quality harvest. In addition to employing irrigation, there are a range of complimentary methods and smaller innovations associated with good litchi production.

Litchi production has been practiced in Inhazonia since colonial times. Much of this production was marginal and dependent on the occasional market connection of an individual farmer, however. The recent growth and expansion of litchi production can be conceived as a bottom-up innovation, largely farmer-driven, and to some extent, facilitated by external actors such as Westfalia, although such external support was more prominent in the initial phases of expansion, as will be discussed later. Amongst those innovations currently spreading in the area, the systematic planting of trees in a grid formation facilitates optimum use of available soil nutrients and makes trees accessible for maintenance of hygiene. West Falia recommend a spacing of 7m x 7m, based on an understanding of the root circumference of a mature litchi tree, yet some farmers in the area opt for a 10 x 10m spacing based on prior local knowledge. It is important to maintain the ground in between trees and ensure the space is kept weed free. Besides competing against the trees for nutrients in water, weeds in Inhazonia present a unique threat as a medium for spreading fire. As discussed previously, the process of burning fields to clear them is common practice in Inhazonia. These fires often cover large areas and easily get out of control, spreading to adjacent plots. Plots which are maintained and kept weed free provide less available foliage through which the fire can spread. While conducting the research in Inhazonia, one participant reported losing half of his litchi crop in this manner. When already expending considerable effort maintaining the ground between trees, some farmers also elect to intercrop their fruit plants with maize or horticulture crops, optimizing their use of space and labour.

Arguably, the most important innovation observed in litchi growers in Inhazonia is that of *shartia*, a type of grafting which transforms a branch from a mature tree into a sapling ready to plant. To make a *shartia*, a suitable branch is identified on the tree and a 4-5 inch section of bark is stripped away just beyond a major node. The exposed section is then blanketed in *musco*, a special type of moss which is found locally on certain trees and is particularly common further into the hills. A



Photograph 3: Plastic wrapped musco on a litchi branch, stage of preparation of a *shartia* (author's own)

plastic wrapping is applied around the *musco*, with salvaged plastic packaging often used with little expense to the farmer. This wrapping is extended slightly beyond the exposed section of the bark, and then tightly tied using plastic cord. The tying of the cord is particularly important as the plastic needs to be airtight at both ends so that the *musco* adheres firmly to the branch and so that moisture cannot escape



Photograph 4: *Shartia* ready for planting with roots protruding from musco (author's own)

from the wrapping. After 45 days, roots can be seen protruding through the *musco*, and after 60 days are mature enough for the *shartia* to be cut from the mother tree. The *shartia* is cut at the node of the branch, below the exposed section of the branch. The *shartias* need to be planted on the same day as they are harvested, although some farmers choose to grow them in pots which serve as a nursery before transplanting in the field. When planting the *shartias*, the base of the sapling is covered in dry grass, also known as mulch, which serves to keep down weeds and preserves soil moisture by limiting evaporation.



4.3. Irrigation

Irrigation is an established aspect of agriculture in Inhazonia, an area fortuitously intersected by numerous rivers which cross the localidade after descending from the nearby Sierra Chôa. As discussed above, farmers generally practice irrigated agriculture on a separate plot (known as an *horta*) than those on which they practice rainfed agriculture. *Hortas* are usually found on areas of lower land close to rivers, preferably at the foot of slight slopes, collecting and soaking up what rainfall is available. With all forms of irrigation practiced in Inhazonia, the greater the distance from the water source to the *horta*, the greater the cost incurred by the farmer, be that in terms of labour or in terms of finance. Some farmers who practice horticulture directly adjacent to rivers opt not to irrigate, explaining that soils here contain sufficient moisture. This is rare however as such a decision limits the size of viable land and renders most water-intense crops unfeasible. Amongst the forms of irrigation practiced in Inhazonia there is a great diversity to be found in the associated cost and labour demand, level of technology, accessibility of required knowledge and physical inputs and, of course, the volume of water they provide to the *horta*.



Photograph 5: Plastic container commonly used for bucket irrigation (author's own)

The most basic and prevalent method of irrigation observed in Inhazonia was bucket irrigation. This method is popular because it is relatively affordable and farmers do not require highly specialised knowledge or equipment for its implementation. Farmers make repeated trips from their preferred water source to their *horta*, carrying a bucket of water (usually 5 to 20 litres) and then apply it to the plot as required. The disbenefit of this low-tech method is that it is strenuous and time consuming. Farmers who practice bucket irrigation explain that it is exhausting to irrigate larger areas using this method and, for those



Photograph 6: Sebastião collecting water from the river beside his *horta* using bucket (pictured above)(author's own)

approaching old age, they are concerned that it is not a sustainable option. To overcome this issue, some farmers were observed to have dug wells in their *horta*, which were filled over the course of some days with the assistance of friends or family, reducing the effort associated with irrigating on subsequent days. This was rare however and generally the physical demand of repeated trips with cumbersome loads makes it difficult and unappealing for farmers who practice bucket irrigation to irrigate large areas or grow water intensive crops.



For those who can, earthen canals and furrows present a more promising means of irrigating. This method is favoured due to low levels of labour associated with its maintenance and high levels of water supplied to the *horta*, although specialised knowledge and suitable land are a prerequisite. Canals are dug from a river to the *horta*, with an informed prior mapping of this route paying keen attention to the slope of the land to facilitate gravitational flow. Offshoots run down onto the *horta* from the main canal, which loops back around to re-join the main body of water. These offshoots are opened and closed by the farmer as required by simply damming with soil or clay, and removing the dam when irrigation is required. Within the *horta* itself, a system of shallow furrows employing a similar system of easily adjusted dams serves to direct the water to different sections of the plot. The seemingly labyrinthine



Photograph 7: Pedro altering the furrows crossing this *horta* (author's own)

system of furrows is constantly being altered by the farmer as s/he sees fit. Some farmers elect to totally erase the furrows at the coming of the rainy season, to prevent soil erosion. To the same effect, the intersection between the main river and the canals are dammed for the rainy season as the high intensity of the water flow would be extremely damaging to the structural integrity of the channel during this period. The

labour associated with implementing this method of irrigation is less intensive than using buckets and is more concentrated at the opening of the *horta*, in April/May.

Some farmers' *hortas* cannot be served by canals as no route with a feasible slope and course can be identified. Farmers additionally report that the levels of water in canals become insufficient in September/October. For these farmers, plastic pipes present an alternative means of transporting water from the main river to their land and are also often used in conjunction with the internal furrows described above. These pipes range in diameter and robustness according to the cost but all are a considerable investment for the vast majority of farmers in Inhazonia. Pipes are laid on the bed of the river and water pressure from above serves to push water through the pipes to the *horta*, where they can be opened and closed using a tap. As this method of irrigation is reliant on there being a sufficient volume of water above the pipes to push the water through, some farmers elect to construct shallow dams to ensure this pressure is more consistently met despite seasonal variability. Dams are usually



constructed using stones, iron bars and cement and, again, are a considerable financial and labour investment up front, but require relatively little effort in their use and maintenance thereafter. Rather than being reliant on natural water pressure or dams, some farmers use pumps in conjunction with their pipes. The two most common types of pumps used in Inhazonia are pedal pumps and diesel pumps. Pedal pumps are quite common in the area as they were previously distributed to contracted tobacco growers but never reclaimed when the company ceased operations there. Farmers explain that using these pumps is very strenuous however and, should you require a large volume of water at the *horta*, simply too much work. Diesel pumps eliminate the effort associated with pumping water but farmers who elect to use them incur a considerable financial burden as a result of having to repeatedly purchase the costly fuel.



Photograph 8: Felipe watering a mature litchi using a hosepipe (author's own)



Photograph 9: Advanced pipes provided to Naume by ARA Centro (author's own)

Besides supplying a system of furrows as outlined above, pipes can also simply be used like hosepipes, with the farmer opening the tap and administering water to the *horta* as required. Sprinkler systems are extremely rare in the area, but present, and are also supplied by pipes. Again, on the more advanced and rarefied end of the irrigation spectrum, some farmers also employ microjet systems. These systems are composed of small tap heads placed at strategic locations throughout the plot (usually at the base of fruit trees) which are served by an expansive system of smaller pipes, supplying a controlled and consistent level of water to the desired location. On the farms where these systems were observed, they were accompanied by large, heavy duty pipes and advanced junction and tap infrastructure.



5. Results 1: Spread of irrigated litchi production

5.1. History of irrigated litchi production in Inhazonia

Litchi trees were first introduced to Inhazonia by Portuguese settlers in the time of colonial occupation. A 30 ha plantation was established on the border between Inhazonia and Makosa featuring a litchi orchard and varied agricultural plots alongside a general store serving the needs of the local elite. The land was later seized by the newly formed FRELIMO state at the dawn of independence. Largescale colonial farms such as the litchi plantation were perceived as valuable assets by the government and a means of retaining modern technologies feared lost with the departure of the Portuguese (Bont et al., 2019). After later being sold into private ownership, the litchi plantation was inherited by current owner, Marcela, in 2007, following the death of her sister. When Marcela assumed custodianship of the litchi plantation 12 years ago the fruit of the trees were small, bitter and generally failed to meet standards required for sale. Using knowledge of irrigation systems from visiting farms during her time as a health and nutrition extensionista⁶, Marcela installed a pump and pipe system to quench the water-parched litchis. While the trees initially thrived, the pump malfunctioned in 2017, starving them of water once again. Without the money to repair the system, the litchi trees are now deteriorating as is the quality of the fruit they produce. While the future of litchi production on the former-colonial farm is somewhat uncertain, it remains a crucial opening chapter in the history of ILP in Inhazonia. Each of the now countless trees found in the area can originally be traced back to this location and this cultivar. The spread of litchi in the area is a story including many actors, yet the first tentative steps litchi took from the plantation into the wider community can be attributed to Peter Waziweyi and Elizabeth Sikoya.

Peter and Elizabeth came to Inhazonia from Zimbabwe in 1992 and began farming on water-rich land they procured in Nhamuzarara I, at the foot of the Sierra Chôa. Coming from backgrounds in business and education respectively, the couple quickly set about moving from simple maize production to commercial seed and litchi production. From self-proclaimed humble beginnings, starting out with a small number of litchis they acquired from the plantation as *shartia* cuttings, the company they went on to create is now the largest commercial litchi producer in the area. Named Nzara Yaperera, the company also produces large quantities of other fruits and cash crops, contracts out 45 one ha plots of land to local farmers for maize seed production and is one of the most important actors in agricultural development in Inhazonia. Nzara Yaperera, meaning “*hunger is ending*” in Shona (a dialect spoken directly over the border in Zimbabwe), is colloquially used interchangeably to refer to both the company and specifically to Peter, a man who has taken upon himself the challenge of eradicating poverty in Inhazonia. He understands the main way to improve people’s lives as instilling ‘vision’ in local farmers and improving their incomes by encouraging the growing of lucrative crops, primarily litchi.

⁶ Extension worker for the government, similar to agricultural extensionista workers, Marcela visited specific farmers villages to educate people about health and nutrition

By the turn of the millennium, this plan was already well underway. Nzara Yapera had established itself as both a commercial farming venture and seed producer and was employing considerable numbers of individuals from the local area as labourers. Those employed at Nzara Yapera benefitted from exposure to a range of new agricultural practices and the tutorship of Peter, trying to instil in them a ‘vision’ for their future. Of these staff, none benefitted more so than Batiste: a former military man who had previously worked for Peter’s father and began working for Nzara Yapera in 1995 as their first employee. Once established as the manager of Nzara Yapera’s farming operations, Batiste began training as Peter’s protégé. Batiste was encouraged to develop his own commercial venture where he could further contribute to combatting poverty in the area, a step he took in 2004. Batiste now has over 1600 trees in the area adjacent to the land on which Nzara Yapera grows litchi in Nhamuzarara I. Nzara Yapera continued to thrive through the 00s, with litchi beginning to appear in the surrounding area and farmers engaging with such innovations. Yet while litchi began to flourish in the area, one question hung heavily over the future of the industry: who was going to buy such volumes of litchi fruit?



Photograph 10: Employees of Nzara Yapera being transported to work on a company truck (author’s own)

Shortly after the turn of the decade Peter travelled to Maputo to attend a large conference where he made the case for supporting litchi production in Inhazonia and tried to secure market access for the Inhazonian growers. The result of this effort was the assimilation of two new stakeholders: *Administrações Regional de Aguas* (ARA) Centro and Westfalia Fruit. ARA Centro are a branch of the Mozambican government responsible for integrated water management at the

level of the different basins. Westfalia are a supplier of fresh fruits and vegetables to the European market. In 2012 both partners came to Inhazonia to invest in the future of litchi production by introducing formal irrigation infrastructure, on the part of ARA Centro, and supplying large volumes of *shartias* to existing producers while guaranteeing market access, on the part of Westfalia. To facilitate this process, two litchi grower associations (LGAs) were established under Batiste, described above, and Anita. Anita was the first female farmer to produce litchi in Nhamuzarara II and since starting out with twelve litchi given to her by Diaz (former manager at Nzara Yapera) in 2007 had managed to accrue over 1,000 trees by this time. The core membership of these LGAs were those farmers already established in the area as litchi growers with irrigation capacities, although some other members of the



local community who met one of these two criteria were also welcomed. These farmers attended a field school where they were instructed on irrigation and the growing of litchis and were later supplied with pipes, pumps and *shartias* purchased from Nzara Yapera.

This spread of ILP within a small cluster of farmers in the areas of Nhamuzarara I and II, later supported by ARA Centro and Westfalia, is now being followed by a new phase of expansion into the wider community. More and more farmers in both Nhamuzarara I & II but also surrounding communities are turning to lucrative litchi production as a means of improving their livelihoods. This subsequent spread is more farmer-led in its nature in that farmers are taking the initiative to negotiate access to the physical and epistemic resources required to engage with ILP by investing not only money, but also labour and time to do so. In the following sections the spread of litchi and irrigation are discussed in terms of this delineation of two distinct phases.

5.2. Spread of litchi and associated innovations

The spread of litchi in Inhazonia can be understood as comprising two distinct yet interdependent aspects. The first of these is the spread of *shartia*, the grafted tree cuttings which need to be planted by a farmer to grow a litchi tree. The second aspect of this process is the spread of knowledge related to plant hygiene and those methods a farmer must employ for their trees to produce fruit of a commercial standard. While the history of litchi in the area dates back to the colonial era, the introduction of *shartia* and the innovations that are associated with commercial litchi production were not employed until Peter established Nzara Yapera's business operations in the 1990's. This development was the first instance of litchi being grown outside of the former-colonial plantation which, at that point, was no longer functioning as a successful commercial venture.

Nzara Yapera's commercial operations marked a pronounced deviation from the type of agriculture that had been predominantly practiced in the area to that point, namely smallscale and low input. Over extensive land holdings, the company began growing cash crops using advanced technologies and trees were propagated using the novel method of *shartia* cutting. Due to the scale of the practice, labour was required for the operation of the farm. These employment opportunities were afforded to a small band of individuals who were, through different channels, connected to Peter. Through this employment, this small cohort of farmers became acquainted with the practice of *shartia*, growing litchi and more advanced and commercially-oriented methods of farming generally. These employees, almost exclusively practicing agriculture on land adjacent to Nzara Yapera in Nhamuzarara I & II, had access to *shartia* and many were gifted with bunches of *shartia* at the conclusion of their employment there. As time passed, an increasing number of this small elite in the foothills began to experiment with litchi and the trees became popular in the area. In addition to experience gained through their employment, farmers were instructed on litchi production by Peter and two early managers from the company, Batiste and Diaz, during visits to their personal farms. Other individuals living or working on land in the area



Photograph 11: Nzara Yapera employees weeding a field intercropped with young litchis
(author's own)

and who were socially connected to Peter also received *shartia* and knowledge in a similar fashion. When the Nhamuzarara I and II LGAs were formed in 2012, these farmers constituted the vast majority of their membership. Through these associations, each member was given either 104 or 208 litchis, depending on their litchi capacity at that point, which Westfalia purchased from Nzara Yapera. At this point Westfalia also provided trainings for members of the LGAs on innovations pertaining to plant hygiene and maintenance.

While this small band of initial litchi growers have continued to expand their commercial operations, this primary phase of expansion has been followed by a subsequent phase whereby these innovations are spreading to the wider community, as described above. While there is temporal and spatial overlap between these phases, this delineation is valuable as the second phase of expansion is more inclusive and bottom-up. In this subsequent phase of litchi expansion, farmers in Inhazonia are accessing *shartia* and associated knowledge from this small band of established litchi growers, following which members of their own social networks subsequently access information from them and so forth. In this fashion, these horizontal social networks are proving the vital life veins through which these innovations are making their way into wider Inhazonia.

More specifically, the four main channels through which these innovations are spreading are 1. Family 2. Friends/neighbours 3. Employed labourers 4. The two local LGAs. For many participants, a high degree of overlap was found to exist between these categories, that is to say that neighbours were commonly found to be a direct relation, or family members were found to be employed to work the land, for example. Binary categories such as those listed above can therefore seem somewhat redundant or abstract when discussing such matters. As such, accounts of specific examples recounted in Inhazonia

have been included through this section to illustrate the more abstract discussion which follows. Generally, farmers were found to access both the physical *shartia* and the necessary knowledge required for their growth from the same individual. While this knowledge package is comprised of a wide range of smaller innovations which constitute overall good practice for litchi production, the results of this research indicated that these smaller innovations are generally transferred from one or two key individuals to the new farmer, rather than smaller innovations being drip fed from various sources.



Photograph 12: A young litchi, planted as a *shartia* one year previous
(author's own)

The most common channels through which these innovations are spreading are tight networks of family and friends/neighbours, with a high degree of overlap between these groups. Family networks in Inhazonia can be expansive and complex – it was common for participants to struggle to correctly identify their blood relationship to an indirect family member encountered while passing through the area. While this is probably partly due to a disregard for the nuanced nomenclature of extended familial relations, it is also indicative of how encompassing the idea of ‘family’ is in the area and the significance that is attributed to kin

networks. ‘Neighbours’ in the context of Inhazonia refers to individuals who own land beside the residence of another or who farm land adjacent to any of their plots. As such, these networks are also more encompassing than when usually used in more developed, urban areas. Due to the nature of family dynamics and social relations in Inhazonia, these two categories were generally observed to comprise the greatest portion of a given individuals’ social network, both in terms of volume and in terms of the importance of the relationships. Due to the cordial nature of relationships within these social networks, the gifting of *shartia* is a common practice, with family members who own mature trees providing cuttings to those in need. The prolonged and amicable nature of relationships between family and friends greatly facilitate knowledge transfer as individuals have repeated exposure to one another and are willing to invest time in one another. As such, for those farmers who reported accessing *shartia* through such networks, the vast majority also received instruction on how to care for the trees and guidance on the

practices of commercial litchi production. Due to the highly specialised nature of knowledge required to grow litchi, which vary greatly from the standard practice of most agricultural or horticultural crops, the flow of knowledge is generally found to be one directional at first. However, as the ‘newcomer’ becomes established as a litchi producer a more collaborative dynamic establishes and, over time, they can create and share new knowledge with others.

Sebastião, who served as guide and translator during this research, first accessed *shartia* back in 2001 using his family network. Sebastião was gifted five *shartia* by his brother-in-law Matias and planted them around his house. Only one of the five young trees survived however, yet in 2005 he went on to plant 19 further *shartia* at his *horta* from this one surviving plant. He learned how to make his own *shartia* cuttings when he attended a training provided by Nzara Yaperá in nearby Catandica. Sebastião now has a considerable capacity to make and sell *shartia*, but to date has only gifted them to three individuals; his teacher at night school where he is completing his primary education, a neighbour who cultivates land beside his and a second brother-in-law. With some years experience growing litchi, Sebastião is now mentoring his younger brother, Anton, on litchi production as he enters into production himself.



Photograph 13: Batiste seated on his motorbike, which he explains to everyone he bought using profits from selling litchi (author's own)

Shartias are also available to purchase commercially for the wider community at a standard price of 100 Mozambican medicals (MZN) per cutting, with Batiste being one of the largest suppliers in the area. More common than purchasing the *shartia* from such suppliers is the practice of exchanging labour for the young trees. In Inhazonia, agricultural labour is not paid at an hourly rate, rather a certain wage is assigned to a given piece of work. The employer will outline the piece of land which requires weeding/sowing/harvesting etc. and assign a wage to the job. Once the labourer has completed the work,

regardless of how many hours the process took, the predefined wage is paid out. Payment for labour using *shartias* is beneficial to both the employer and the labourer (should the labourer be interested in producing litchi). While purchasing *shartia* directly costs 100 MZN per tree, when given as a wage, one *shartia* is paid out per 75 MZN. As such, the labourer saves 25% as opposed to purchasing the trees directly and the employer benefits as the financial burden of producing *shartia* from a mature tree is extremely low. To facilitate planting in the rainy season, farmers who require labour at different parts of the year allow labourers to accrue a *shartia* credit which they can come and collect all at once when the time of year allows for planting. This is important as *shartia* need to be planted the day they are cut from the mother tree and because labour demands are highest during the dry season.

Most employers and labourers reported that knowledge on growing litchi usually accompanies payment through *shartia*. This training is normally conducted on the employer's farm following the end of the days work, using fully-grown trees on-site as examples to demonstrate good practice. Some employers also reported visiting labourer's farms after planting to ensure good practice was being followed. Important to note about this means of litchi expansion is that members of an individual's family and friend/neighbour networks were almost exclusively cited as those employed as labourers. Labour serves as a vital means of supplementing household income for farmers who do not operate *hortas* or who are experiencing a bad season. Those who can offer labour therefore tend to give this opportunity to those they have close connections to, in their immediate circle. It is also self-explanatory that such opportunities are concentrated in the hands of close relations rather than strangers of whom the employer is not aware.

An interesting example from of how labour networks overlap with those of family and neighbours relates to Cezartino, a 40 year old farmer who lost a significant portion of his litchi crop two years ago when fire from an adjacent field, being burnt, spread to his own land and scorched his trees. Accepting responsibility for the damage done to Cezartino's litchis, his neighbour offered to replace his lost trees by supplying him with *shartia*. Cezartino acquired the new *shartia* from his nephew, Trimo, and in return the neighbour is required to labour on Trimo's land, as required, until his debt is paid off.

While the subsequent phase of expansion is more decentralized and driven by farmers, the LGAs and Nzara Yaperera are still important sources of knowledge for farmers entering into litchi production. While their role as suppliers of *shartia* has diminished over time as the crop spreads, they have a wealth of knowledge for potential growers who often consult them prior to and during litchi production. Besides personal consultations on visits to growers' farms, Nzara Yaperera holds workshops and trainings where farmers are instructed on a range of different practices. In addition to this more formal kind of knowledge transfer they still drive innovation in the area through introducing employees to the growing of litchi while in their employment. On one of my first visits to the home of my local guide and translator, Sebastião, he proudly showed me his certificate from Nzara Yaperera declaring him a certified *shartia*

producer. The two local LGAs also serve to distribute knowledge from the larger Manic Litch Growers Association (MLGA) to their members.

Table 3: Sources of shartia and knowledge for litchi producers, and who they have in turn provided with these resources

Farmer	Supplier of shartia	Supplier of knowledge	Supplied shartia to	Supplied knowledge to
Sebastião	Matias (brother-in-law)	Nzara Yopera	Maizinmbda (nephew)	Anton (brother)
			Chingrai (newphen-in-law)	
Kefasi	Nzara Yopera	Employer as garden boy in Zimbabwe		Kimbizi (brother-in-law)
		Nzara Yopera		Pedro
Pedro	Batiste	Kefasi		
	Diaz	Batiste		
Victorno	Batiste (nephew)	Batiste (nephew)	Fernando (brother)	Fernando (brother)
		Nzara Yopera	Friends (labour)	Friends (labour)
Cezartino	Diaz	Batiste	Friends	
	Trimo (newpew)	Nzara Yopera	Family	
Anton	Batiste (labourer)	Sebastião (brother)		
		Nzara Yopera		
		Batiste		
Dave	Cezartino (brother-in-law / labourer)	Cezartino (brother-in-law)		
Batiste	Nzara Yopera	Nzara Yopera	Various	Various
Alsinda	Nzara Yopera (husband employed there)	Nzara Yopera (husband employed there)	Labourers (friends)	Labourers (friends)
Felipe	Nzara Yopera	Nzara Yopera	Brother (labourer)	
		Batiste (neighbour)	Nephew (labourer)	
Naume	Anita (mother)	Anita (mother)		
Joqim	Batiste (neighbour)	Batiste (neighbour)	Natoria (neighbour / labour)	Natoria (neighbour / labour)
		Nzara Yopera	Paulino (brother-in-law / labourer)	Paulino (brother-in-law / labourer)
Fernando	Batiste (nephew)	Batiste (nephew)		
	Victorno (brother)	Victorno (brother)		
Anita	Diaz (brother-in-law)	Diaz (brother-in-law)	Naume (daughter)	Naume (daughter)

5.3. Spread of irrigation

Smallholder furrow irrigation, developed in the absence of external intervention, has a longstanding history in the mountainous border region between Mozambique and Zimbabwe. Literature suggests a considerable contribution to such developments as far back as the early 20th century has been refugees fleeing colonial repression in then-Rhodesia (Veldwisch & Bolding, 2013). Indeed, farmers from Zimbabwe interviewed as part of this research explained that irrigation is much more commonly practiced in their home country. As such, Zimbabwean immigrants have served as a means of bringing innovations in agriculture to the area in the past and none more so than Peter Waziweyi who returned to Inhazonia from Zimbabwe in 1992. While both Mozambican and Zimbabwean farmers throughout the area have gained experience in irrigation while spending time there, the central node through which innovation in irrigation has spread is that of Peter and Nzara Yapera. The extensive land holdings of Nzara Yapera use large quantities of water in the production of a wide range of crops. While nowadays much of their land devoted to fruit production is served by high-tech pipe and micro-jet systems, considerable hectares are still serviced by canals dug from rivers running down from the Sierra Chôa. Besides knowledge on the physical construction and implementation of such canals and irrigation more broadly, Peter has served as a source of knowledge about innovations required to operate the kind of more intensive horticulture which irrigation enables. These innovations relate to the use of fertilisers, pest management and experimenting with different crop varieties. Again, while other immigrants from Zimbabwe report having gained knowledge of such practices from their personal experience in Zimbabwe, it is through Peter and Nzara Yapera that these innovations have mostly been transferred to Inhazonian agriculture. Like the initial spread of *shartia* and related innovations, innovations in irrigation first spread to the small group of farmers who owned land adjacent to Nzara Yapera's and who were employees or were otherwise connected socially to Peter. Through these individuals, some of the first and most prominent canals of Inhazonia were established in the areas of Nhamuzarara I and II. Now a subsequent phase of expansion is seeing these innovations trickle out to the wider community.

The spread of irrigation to members of the wider community is predicated on the principle that everyone has the right to use water. As such, other farmers in Inhazonia connected to this small group of elite have managed to access irrigation through joining the pre-existing canals that have been built by these individuals. The construction of new offshoots from pre-existing canals or elongating existing canals to reach new plots like this is a vital aspect of the spread of irrigation in the area. Farmers in Inhazonia reported negotiating access to these pre-existing structures through a wide range of different arrangements, sometimes entailing a financial component, other times not. Once a given individual has established their right to water, they cannot be deprived of this right however. Late comers can therefore be denied access to canals by original owners and have their rights alienated in this fashion. As such, when a farmer constructs a canal, investing time and money into the venture, they can then regulate access to the canal to newcomers to ensure their supply is not depleted by others. Additionally, they

assume responsibility for managing its maintenance and can request money or appoint tasks to others canal users to this end. Therefore, while everyone is afforded the right to water, it is sometimes necessary to negotiate access to this resource through arrangements with such canal operators. Arrangements which featured a financial component took the form of a once off buy-in-fee rather than recurring water fees or annual quotas. While these buy in fees entitle the newcomer use of the canal, the quantity of water which they are entitled to is not unlimited and is reflected in the cost of the buy in. Farmers explained that when they arranged access to canals in the past, what areas of their land and what crops they would water was prearranged and determined the cost of the buy in. Should they wish to expand their irrigation capacity, a further fee would need to be paid. Only one example of a canal operator who did not demand financial compensation in exchange for access was observed, namely the canal operated by Batiste. He explained that he felt he had no right to demand money in exchange for water as water is everyone's right. This approach is in line with the ethos of local development which was instilled in Batiste during his training at Nzara Yaperera.



Photograph 14: An earthen canal with offshoot to farmers horta (right), currently closed, and route leading back to main channel of river dropping off towards the top of the image (author's own)

Victorno is a 46 year old farmer who has been in Inhazonia since 2007, previously cultivating land in Gorongosa. Despite planting his first litchi in 2011, he only sold fruit to Westfalia for the first time in 2017, which he attributes to a lack of sufficient water up until that point. Victorno initially opted for bucket irrigation to maintain his trees, unwilling to pay the local canal operator to access water. When in 2016 his trees still did not provide fruit, he begrudgingly approached the local canal operator to negotiate access to irrigation for his litchis. For a once-off fee of 1500 MZN, a new junction was opened from the main channel and Victorno dug a connecting offshoot to his *horta*. The following year his litchis produced fruit for the first time. Notable about this arrangement is that the initial buy in fee did not represent the cost of entry, with unlimited

access, but rather only allowed Victorno enough water to irrigate his litchi. Now considering expanding his irrigation capacity to supply water to horticultural crops he also grows, he will need to reach a new agreement with the canal operator and pay another fee.



Fernando is farming in the area since 2010 and is 32 years of age. He has been using canal and furrow irrigation since 2012 when his neighbour, from Zimbabwe, built a canal which ran close to his own *horta*. He has 102 litchi, 6 lemon and 5 mango trees in his *horta*, first planting litchi in 2016 using *shartia* from Batiste, his nephew. He planted further trees in 2017, this time sourcing his *shartia* from Victorno, his brother. 10 farmers are connected to this canal, three of which are growing litchi. Being towards the tail end of the canal, Fernando got assistance from the other users to extend the canal to his plot. Having paid when the canal was initially constructed, Fernando paid a fee of 1500 MZN for unconditional use of water from the system but explained that people paying this year are expected to pay 3500 MZN. At the opening of the canal, the operator did not exclude neighbours from joining if they could not afford it at the time. Rather, he allowed everyone access but has added interest onto the initial fee yearly, a type of tax on the ‘free’ water which those who could not pay have been using in the meantime.

There are various reasons why joining a pre-existing structure like Victorno and Fernando may not be a feasible option for a given farmer requiring irrigation. As discussed above, farmers can be denied access to pre-existing structures on the grounds of ensuring sufficient resource availability for pre-existing members. Joining onto the canal is also predicated on being socially connected to the operator, such that negotiating access can take place. Finally, there are also spatial boundaries which serve to limit who can join a canal. This option is only viable for farmers whose land falls within a certain proximity of the main channel of the pre-existing structure. Beyond this radius, the maintenance of lengthy secondary channels would become too challenging, be that in terms of labour or in terms of capital. The second phase of the spread of irrigation in Inhazonia therefore features more farmers who are developing new irrigation systems that are not reliant on the early canals in Nhamuzara I and II which are a considerable distance from their land. For such farmers the construction of new canals is one option, while alternatives such as pumps and pipes are a favoured alternative for some. As such, there are a range of modes through which irrigation is currently expanding in Inhazonia.

Few farmers have the knowledge required to undertake the task of planning and dredging a new canal alone so that, for those who choose to do so, external assistance is required. The collective knowledge on the construction of canals in Inhazonia has steadily increased as more people gain experience from working at Nzara Yapera and sustained immigration from Zimbabwe brings more and more individuals with personal experience of such innovation. Members of the wider community who can access the knowledge of such individuals can therefore engage with irrigated agriculture. The most common fashion in which farmers reported accessing such knowledge was through their networks of family and of friends/neighbours, as with litchi.



Trimo is a young farmer around the age of 30 who shares a 6 hectare plot of land with his mother, Irisa, in Nhamazao. While sharing they land, they each with their own distinct plots within the plot. Currently they only cultivate 3 of the 6 hectares, with a lack of seeds and labour the reason that half of their land has been left fallow for three years, now thoroughly overgrown. They came to Inhazonia in 2004 from Zimbabwe, where he grew up, as his father is from Inhazonia and they were able to secure water-rich land there in Nhamuzarara II. Since arriving in the area Trimo has dug a canal to service his land, under the instruction of his mother who used such methods while farming in Zimbabwe. Now he grows a range of horticultural crops and sesame seeds, fed by furrows which spread across his plot and plans to plant litchi the coming year.

Such knowledge can also be acquired commercially however, with local entrepreneurs versed in the construction of such channels available to hire. The duration of the job and associated fee varies depending on the distance of the channel to be dug. Pedro, a 39 year old farmer who has a 1 hectare garden in Nhamuzarara where he is growing litchi for the first time this year, having seen how well other farmers are doing from selling the fruit. His *horta* is connected to a nearby river by a personal canal of approximately 80 m which was first dug in 2014. Pedro dug this canal with the assistance of a man who used to come to his *horta* to purchase produce from him and remarked one day that his land was well suited for a canal to be dug from the nearby water source. For a price of 3,000 MZN the man and two friends of his helped Pedro to dig his canal over the course of three weeks. Now every year, Pedro spends five days dredging and maintaining the channel before re-opening the junction between his canal and the river, before the dry season. Before this entrepreneur later moved to Honde, the brother and friend of Pedro both also enlisted his services.



Photograph 4: Pedro proudly demonstrates his canal (author's own)

Due to unfavourable distances to nearby water sources or undulating topographies, some farmers cannot construct a canal to their property like Trimo or Pedro. For other farmers the seasonal variability in water levels also highly impacts the volumes of water such canals can provide to their land at different

parts of the year. For these farmers, pumps and pipes present a viable alternative. In terms of the spread of pipes and pumps, Nzara Yaperera and time in Zimbabwe were again an important means of exposure to these innovations and an opportunity for farmers to observe how effective they are. Both means of irrigating are extremely expensive for the average resident of Inhazonia however and, for most, are a plan for the future, rather than a current reality. Besides the larger, commercial farms which have secured such resources through partaking in development projects, pedal pumps are found dotted throughout the area left behind after a tobacco contractor concluded operations in the area. Manually operated pumps are reported to be too strenuous to operate and diesel pumps too costly however, making pipes a favoured option. For those farmers with immediate plans to purchase pipes, they explained that they would travel to Zimbabwe to do so as they are considerably cheaper there. In this sense, farmers who are from Zimbabwe or have spent time there, know the country and people there are at a marked advantage in terms of trying to secure pipes through networks of family and friends there.

Though rare in Inhazonia, small dams are sometimes used in conjunction with pipes to maintain water pressure and combat seasonal variability. These dams span the width of the river and while they are not exceedingly tall they are extremely expensive to construct, requiring cement and steel or iron bars used in conjunction with stones. Only one participant reported having begun preparations to construct a dam, my translator and guide, Sebastião. Having already acquired some pipes from a friend, Sebastião had established contact with farmers who had land next to his who could potentially also benefit from the construction of the dam, creating a mini-association where they would share the financial and labour burden of its construction and then all access water from it. The estimated cost of the venture was 10,000 MZN to be divided across the five farmers.

5.4. Preliminary conclusions

While both the spread of innovation in litchi and innovation in irrigation in Inhazonia can be broken down into two distinct phases, both phases share some common characteristics that provide interesting insights. The initial phase of expansion of both innovations can be characterised as being concentrated in a small band of farmers who were personally connected to Peter or Nzara Yaperera. The subsequent phase of expansion in the area can be characterised as being concentrated in those farmers who were personally connected to the former group of elite farmers, subsequently spreading to those directly connected to them and so forth. The defining characteristic of the overall spread of ILP in the area is that it is spreading through small, close-knit networks of highly connected individuals. There are various mechanisms and processes which allow a farmer to access the necessary resources to engage in ILP in Inhazonia, but all of these are predicated on well-developed social relations.

The various ways in which farmers have been observed to access water in the area serves as an illuminating illustration of this point. Everyone in the area has the right to derive benefit from the water resources but not all farmers are able to successfully do so. This is the distinction between traditional ideas of access founded in property rights and more contemporary ideas of access, as discussed by Ribot

& Peluso (2003). Certain farmers have their rights alienated by the owners of pre-existing structures, based on fears of insufficient water levels in the existing channel. However, such farmers can derive benefit from the abundant local water by tapping into the knowledge of those in their social network to build their own irrigation infrastructure. By the same logic, all farmers have the right to grow litchi, yet the contribution of observation in the absence of personal contact, or ‘learning by seeing’ to the spread of these innovations in the area was found to be negligible. The highly specialised nature of knowledge required to grow litchis and the physical requirement of *shartia* means these innovations are not accessible for all farmers. For this specific set of innovations, the idea that a farmer wandering through their local area would observe a field of fully-grown litchis and have the capacity to implement these innovations themselves is unrealistic. The knowledge gap and physical requirement of *shartia* make entering into litchi production unfeasible for most farmers unless they can manage to access these epistemic and physical resources required through their social networks.

For farmers who have well developed social networks and know other farmers practicing litchi production, the technical aspect of these innovations was not found to be a serious barrier to implementation. This contradicts traditional theories that attribute extrinsic factors of the technical aspects of the innovation and area of implementation as primary explanatory variables in the rate of uptake of a given innovation and indeed which farmers are the first to do so. Through continued exposure to friends and kin, farmers were observed to overcome those technical challenges that arose in terms of the growth of litchi, once they were able to access water. As such, the spread of litchi in the area is a question of access, mostly achieved through these close-knit social networks. Those individuals who are socially connected, initially, to Peter and, subsequently, those local elite who had successfully engaged with ILP are able to access the necessary resources, whereas members of the wider community are excluded. As such, the spread of ILP has travelled through social networks of individuals who utilise these links to access innovation. Mostly people access these resources through family members or close friends/neighbours. Marginalized individuals are therefore at a marked disadvantage, even highly motivated or wealthy farmers.



6. Results 2: Replicability of innovation

This section will analyse the spread of litchi outlined in the previous chapter in terms of its replicability by trying to understand more concretely which farmers have been able to engage with the innovations of ILP and how. The chapter opens with a discussion of how key development actors understand drivers of development in the area and what distinguishes an ‘innovative’ farmer from the wider population. Subsequently, the barriers that farmers grapple with when trying to engage with ILP will be outlined. Finally, what these results indicate about the true distinction between ‘innovative’ and ‘non-innovative’ farmers will be discussed, contrasting these findings against the perspectives expressed by development actors.

6.1. Perspectives of key development actors

The perspectives of key development actors are important to consider as they underpin initiatives taken to stimulate development, innovation and reduce poverty by such actors. An understanding of the causes of poverty and how best to address them dictate approaches adopted by actors and directly influence project design. While central to development work, there is far from a consensus on these matters however, and the variety of opinions and beliefs on this front can go some way to explaining the sometimes uncoordinated or contradictory work of different actors within a given location. More specifically, there are highly contrasting beliefs on how best to raise agricultural productivity and household income of farmers and how to foster innovation within the sector. The government’s belief in high-modernist solutions to the perceived failings of agriculture in Mozambique has so far failed to meet the needs of the rural population however. Coupled with the low capacity of under resourced extensionistas, for many Mozambicans agricultural development more readily stems from development projects and the private sector than the state. In the absence of effective state institutions and due to the often-ephemeral nature of development interventions, Peter Waziweyi is arguably the most prominent and well-respected voice in Inhazonia on this front.

Peter’s intervention has served as a catalyst for agricultural development in the area and continues to drive the expansion of lucrative ILP. Through the vast number of local farmers who have been in his employment or attended trainings hosted by Nzara Yaperera, his ideas around agricultural development are steadily percolating the collective mindset of farmers who often echoed his perspective in interviews. The political power and social standing of this ‘living national hero’ ensure his ideas influence individuals across all tiers of Mozambican society and further afield. His conceptualization of development can be concisely conveyed in one word: ‘vision’. He describes the characteristic of possessing ‘vision’ as the ultimate driver of change and, concomitantly, the lack thereof as the main thing restricting people’s capacity to improve their livelihoods and escape poverty. This idea of ‘vision’ is ambiguously vague and encapsulates a broad range of ideas. In its simplest form however, the term implies the ability to formulate and exact plans for the non-immediate future. Scratching beyond the superficial surface of this explanation, the assertion is that all of the resources motivated farmers need



to succeed in agriculture, and life itself, are at their fingertips should they only realise this and take advantage of them. What ‘vision’ entails and what it looks like in real life is best illustrated through examples recounted by farmers from Inhazonia who also subscribe to this idea of development, notably those who fortuitously have engaged with commercial litchi production to date.

When talking to farmers in Inhazonia, the most common response to the question “*why are more people not growing litchi here when it is seemingly a very good way to make money?*” is “*people here are lazy, they only want to grow maize and then drink beer*”. This common held belief suggests people are not willing to engage with new innovations because they do not have the right mindset and are simply lazy and uninterested. This response fits perfectly with the ‘vision’ narrative which Peter perpetuates through day to day conversations, his mentoring of employees and his work with those in the development community. This is a dangerous characterisation of disadvantaged and impoverished people however, attributing their failure to engage with the expanding litchi sector to an unwillingness, due to mindset, rather than an incapacity, due to circumstance. When talking to commercial litchi producers in the areas of Nhamuzarara I & II this general idea and this specific answer to this question were highly prevalent, with people’s aversion to work and fondness for liquor repeatedly suggested as the root cause of less successful farmer’s misfortune. This understanding of innovation and development shows little to no regard for ideas of access as described in the previous chapters, portraying all farmers as being on a level plain with mindset or ‘vision’ alone distinguishing the successful from those worse off.

Naume, daughter of the president of Nhamuzarara II LGA and recent litchi grower, gave anecdotal evidence of how farmer’s lack ‘vision’ in the area, describing the frustration she has encountered in trying to convince more people to grow litchi. Laughing, Naume responded that they have encouraged many people they know to grow litchi but to little avail, as they will not plant something that will not produce fruit for four years. “*I’m not going to plant something I will never eat*”, they explain to her, “*I will die before those four years are up, why would I plant the tree for someone else to eat the fruit?*”. Understanding this as an issue of mindset shows little consideration for the serious financial component of what these farmers are saying, with four years of no return after a considerable investment inconceivable to such people. In understanding this solely as a issue pertaining to the mindset of people, there is a focus on trying to totally alter the mindset of people perceived as ignorant, rather than raising their capacity. This is why Peter and Batiste are focused on this issue and trying to convince people of the merits of investing in your future, not focusing on where such investments can be sourced. So far, they have found the best way to do this is to effectively flaunt the fruits of their own successes, showing off the houses and vehicles they have been able to afford through producing litchi. They claim this approach is successful as when people see how lucrative litchi production is, they suddenly change their mindset and decide to engage with litchi production. Unfortunately, these examples generally illustrate a patronising portrayal of the poor, with little acknowledgement of the realities of poverty.

A slightly more nuanced and concrete phrasing of the ‘vision’ narrative described this key driver of development as the ‘business mindset’. An example of this mindset in action was described in relation to the harvesting of maize in June. For half of the year, most farmers grow maize almost exclusively. The harvest is spread across home consumption and that for sale at the local market and to largescale purchasers like ECA. Maize is usually left to dry in the fields on the plant for some months before harvest in June, vulnerable to scavenging by local thieves. Farmers who possess the ‘business mindset’ make estimations of their yields and profits before harvest and make a plan for their turnover. Such plans range from setting aside some money for more seeds to investing in pipes for irrigation and even saving for a car to transport produce to distant markets, as reported by one commercial farmer. One respondent reported that when they harvest their maize, they treat and store it for use in exchange for labour in the hungry months when food is scarce and expensive. By contrast, most farmers harvest their maize slowly and in stages, with no overarching plan. Regular trips are made to the field and maize harvested as required to meet the household needs or to sell and pay for expenses as they arise, until exhausted. The claim is that without a defined purpose for the slim margin upon which profit can be made, the little that could be saved, accumulated or reinvested tends not to be, and individuals find themselves in repetitive cycles year after year. This is a narrative that is not only common in Inhazonia but in wider development discourses.

Broadly put, this narrative claims that poor people are poor because they make bad decisions. Phrased more academically, Bradshaw (2009) explains that the idea that poverty is a result of individuals and their decisions is one of the five common approaches to community development. Individuals who subscribe to this belief “*blame individuals in poverty for creating their own problems and argue that with harder work and better choices, the poor could have avoided (and now can remedy) their problems*”, with variations of the individual theory of poverty ascribing poverty to a “*lack of genetic qualities such as intelligence that are not so easily reversed*”. This approach proposes that escaping poverty or improving your livelihood is a realistic option for poor people, should they take initiative, make better decisions, plan more effectively and capitalise on all the small margins that exist in their daily existence. This resonates clearly with the ‘vision’ narrative. Unfortunately, this perspective can lead to the design of development projects which facilitate elite capture though focusing on and rewarding the ‘motivated’ or ‘innovative’ individuals who are making the ‘right’ decisions. As such, those who already have the capacity to make improvements in their lives benefit while those trapped in stifling cycles of poverty are neglected. Indeed, when we look at the history of development interventions in litchi in Inhazonia, such an approach is evident. While Peter’s influence certainly steered the aid provided by Westfalia and ARA Centro, the interventions were almost exclusively focused on those already growing litchi and/or practicing irrigation. As such, those who were able to access such resources through their social network and were arguably less in need of such aid than those more marginalized and socially isolated farmers, were rewarded.

Aspects of this understanding of development were also observed to factor into the process of participant selection for the APSAN-Vale project. In an interview with one of the HUB core staff who conducted interviews in Inhazonia to identify the group of fifteen model farmers to be included in the project explained that previous involvement in development projects was an important criterion employed. When asked what the reasoning for this was, he explained that individuals who had been involved in a range of projects in the past are favoured as these individuals are arguably more interested in improving their practices and are more motivated. More specifically it was also stated that such farmers who successfully partook in projects could be trusted not to simply sell pipes, seeds or other resources afforded to them by the project. The logic of this approach is understandable; recruit the people who are motivated and will commit to the project, especially considering a core element of APSAN-Vale is to develop demo plots with the core participants through which to access the wider community. Nonetheless, the approach presents the opportunity for elite capture, especially considering the selection of politically and socially connected farmers for development projects in the past.

Perspectives on development prevalent in Inhazonia fundamentally centre on the idea that the reason certain people succeed whereas others fail, is that successful farmers possess an inherent quality of ‘vision’ or a ‘business mindset’ which distinguishes them from their peers. While some farmers acknowledge that these characteristics can be instilled in people through education, the underlying premise is that the intrinsic nature of people is what distinguishes innovative farmers from the rest, with little consideration for the plethora of barriers which stand between people in poverty and their plans and goals. These barriers cannot simply be transcended through mindset, but rather must be tackled through accessing different resources. The specific barriers which farmers who wish to engage with litchi production in Inhazonia must face are discussed in the following section.

6.2. Barriers

There are several barriers to entry which a farmer wishing to engage with ILP must overcome. Most simply put, each of these barriers is a specific resource which the aspiring litchi producer must access to enter the practice, contradictory to the perspective of key development actors discussed above. These barriers are discussed below, beginning with the most fundamental.

6.2.1. Land and water

Having access to land on which you can physically grow the trees is the most fundamental prerequisite for aspiring litchi growers. Land is a relatively abundant resource in Inhazonia however, and for an individual who is not already cultivating agricultural land to want to engage with commercial litchi production is highly unrealistic. The two main concerns that then arise are the nature of an individual’s access to land and the availability of water on this land.



As discussed by Schultz (2019)⁷ there are various routes through which individuals access and subsequently use land in Inhazonia. Formal land rights recognized by the state in the form of DUATs are rare and by Mozambican law all land is technically the property of the state and cannot be privately owned. Land access is therefore governed by ‘informal’ agreements, local laws and customs. While such institutions exist at the local level, with land ‘illegally’ being transferred between individuals and money often exchanging hands, land disputes are common according to a local chief. During the course of this research, one respondent who had been farming an area of land in Nhamuzarara II encountered such difficulties. With the arrival of a stranger who claimed his father owned the land Cezartino works, he lost half of his farm to the newcomer after a local court ruled in his favour. While such cases do arise frequently, most farmers are not dissuaded from investing in their land and planting litchi as shown by Schultz (2019)⁸. The exception to this is farmers who are explicitly renting their land only for a short-term period. Planting litchi presents a considerable up-front cost and no returns for at least four years, making it economically unfeasible for farmers who do not have long-term access to the land on which they plant the trees. One interesting exception to this was a husband and wife who were renting land from a family member and planted litchi as a means to secure the land they farmed. They trusted that should the relative wish to reclaim their land, local authorities would require her to compensate them for their trees, something she would not be able to afford.

One of the highest educated and most innovative farmers interviewed during the course of this research was not able to grow litchi due to the nature of her access to land. Amelia is 33 years old and first learned about agriculture at a young age from her father, who worked an office job but also cultivated land. Before coming to Inhazonia Amelia was a teacher and came to the area in 2015 to work as a nurse in the local hospital. She is a highly regarded farmer in the community, a member of a farmer’s association where she introduces members to new crops and spoke often of the importance of experimenting with different types of crops to determine which are best suited to particular soils. Not originally from the area, she struggled to acquire land in Inhazonia when she arrived, having no familial or political ties in the community. She currently cultivates a plot afforded to her by a friend, Margarita, where she practices bucket irrigated horticulture. Although she is aware that people in the area are making a considerable profit from litchi, she explained that the land she works is not hers and there is a time limit on her access to it. As such, it is unlikely that she would ever fully recuperate the money she would have to invest to start growing litchi and the financial benefits would most probably be reaped by Margarita when she takes her land back.

^{7 & 8} Findings of unpublished thesis by Isabella Schultz, Utrecht University, who conducted field research in Inhazonia alongside this research in 2019

Besides this issue of the nature of land access, the availability of water on accessible land also presents a serious barrier to farmers. The water demands of litchi mean that trees cannot produce fruit unless provided with water throughout the dry season and time of harvest. For farmers who can only access land a great distance from a viable water source, litchi production becomes practically impossible and only achievable through intense investments of time, labour or money in irrigation. Therefore, while all farmers have the right to benefit from the water resources of the area, the location of land which farmers can negotiate access to sometimes alienates this right somewhat, making accessing water extremely difficult.



Photograph 5: Commercial litchi production in the water-rich land of Nhamuzarara I (author's own)

One farmer currently grappling with such issues of access to water in Inhazonia is Kefasi who, at 83, claims to be the oldest farmer in the area. He has been farming since childhood and first learned about growing litchi when he was a garden boy in Zimbabwe, furthering his knowledge of the innovations associated with growing the trees while employed at Nzara Yopera. He began his own litchi practice 8 years ago using *shartia* he purchased from the company. Kefasi waters his eight litchi trees twice a week using bucket irrigation but now, in old age and deteriorating health, this task is proving too strenuous and something he cannot maintain. Last year he enlisted the help of friend, farmer and canal operator, Pedro, to assist him with the construction of his own canal. He hoped this would allow him to continue irrigating his trees while eliminating most of the labour associated with doing so. Despite concerted efforts over a number of days to find a channel to a nearby water source, Pedro and Kefasi eventually resigned to failure as the only viable water source turned out to be on lower ground. For Kefasi, purchasing pumps and pipes is not economically viable. Unable to continue bucket irrigation or establish a canal and furrow system only one of Kefasi's eight litchi's fruited last year and the fruits were of poor



quality. He laments his ‘loss of power’ and fears that his trees are destined to wither without their water demands met. Despite taking the initiative to establish his litchi operations, the lack of access to water on his land coupled with his old age is making litchi production impossible for him now.

6.2.2. Capital

For those farmers who have access to water-rich land, having the financial capital to enter into ILP still presents a considerable barrier to most. The main part of this financial burden is embodied in the purchase of *shartia* cuttings and investing in the required irrigation infrastructure. The nature of the monetary investment here is compounded by the fact that farmers cannot expect to see any return on their investment for at least four years. This is a considerable period to most farmers and the risk of some unforeseen circumstance potentially wiping out these benefits is serious. Therefore, even the most innovative of farmers are restricted by their financial security and can only enter litchi production should they have a considerable degree of economic mobility. In terms of *shartia* for example, which are usually sold at 100 MZN per cutting, the cost of growing even a small number of trees can rapidly mount for a smallscale farmer, especially when contrasted against the 8 MZN/kg they can expect to receive for their maize at market. The most commonly cited way of circumventing this issue is through working on the land of friends in exchange for *shartia*, as described previously.

Dave, a 39 year old farmer who has been living in Inhazonia since 2016, plans to use this method to acquire *shartia* for his land, in the water rich area of Nhamuzarara I. He lives beside his brother-in-law Cezartino, who is growing litchi for ten years since leaving employment at Nzara Yaperera. In the month prior to our interview, Dave had constructed an offshoot from a canal which was re-opened by Cezartino and another brother-in-law of his in 2007. With his newly implemented irrigation capacity, Dave wants to begin growing litchi on his farm to accompany the horticultural crops and two lemon trees which were previously bucket irrigated. Currently, purchasing *shartia* for this next step isn’t financially viable for him however. Instead, he will work on Cezartino’s farm throughout the course of the dry season and plant the *shartias* he has earned when the rainy season begins. As such, Dave has managed to circumvent this barrier through utilising his kin network to negotiate access to *shartia*, investing in them through labour rather than cash.

Once a farmer has managed to purchase or acquire *shartia* to begin litchi production, further investments are often required to ensure sufficient access to water. The various methods of irrigation differ considerably in terms of cost but generally all increase with the relative distance to the source of water. Dave and Cezartino are currently grappling with the financial aspect of irrigating litchis. The water level in the canal they share tends to become insufficient in September or October, right before litchi harvest. As such, they are not granting permission to any other neighbours of theirs to join the canal currently. To remedy this issue, they plan to construct a shared dam and use this in conjunction with individual pipes and pumps to improve the volume of water which reaches their respective plots. This process is highly expensive however and to begin with they have their sights set on acquiring the pipes, with dams



costing in the region of 10,000 MZN to construct. At present, even this is not an economically feasible option for them, and they are faced with the prospect of their crop deteriorating unless they can find the capital to purchase these resources. This task becomes considerably cheaper for socially connected individuals with family or friends in Zimbabwe, where pipes are reported as being less expensive. Some farmers interviewed reported that they plan to visit family in Harare and purchase the pipes while there or, even better, request family to bring the pipes upon visiting Mozambique, further reducing the financial cost of transport.

While litchi production is indeed a lucrative venture, it presents a considerable and, for many people, unsurmountable up-front investment that is not common to other crops grown in the area. The unique nature of this financial investment is compounded by the lack of microfinance options in the area. As such, setting aside enough money to purchase *shartia* and irrigation is often impossible for farmers unless they can manage to access these resources, or diminish the cost of accessing these resources, through utilising their social networks, as exemplified above.

6.2.3. Knowledge

For those who successfully manage to access water-rich land on a long-term basis and have the financial security such that they can invest in *shartia* and irrigation, one final, less tangible, barrier stands between them and successful litchi production. Indeed, a fundamental aspect of any definition of innovation is that of some individual being exposed to new knowledge about a given idea or practice. Therefore, a core barrier to farmers who wish to begin ILP pertains to knowledge of the innovations associated with the practice, namely those practices of good plant hygiene, how to access the market etc. This barrier is a common focus of research on innovation, rather than those more physical barriers previously listed, which are somewhat more specific to this specific innovation. Examples from Inhazonia better illustrate this barrier in this local context.

Felipe is 51 years of age and is a prominent litchi producer growing on land adjacent to that of Batiste in Nhamuzarara I. Despite his current success, bolstered by the assistance of ARA Centro and Westfalia, when Felipe first experimented with litchi he encountered considerable difficulties. After gaining some experience in caring for litchi trees at Nzara Yaperera, he planted a small number of trees after leaving employment there in 2002. This first few litchis he planted did not do well, despite the ample availability of water from a nearby river. Felipe consulted Batiste on the matter and was advised to alter the spacing of his trees and plant them in a grid formation to optimise the availability of water and nutrients for the trees. In 2007 he planted 37 trees using the advice of Batiste and has enjoyed a much healthier crop since. Felipe now has in the region of 500 trees and is a member of the Nhamuzarara I LGA where members exchange their experience and share ideas on how to improve one another's practice. The association also provides him with access to Westfalia and when to harvest his crop for collection days when Westfalia trucks come to Batiste's farm to collect the members' produce. The association also provides Felipe with information from the larger MLGA that was established by Peter. Batiste attends

MLGA meetings on behalf of members, often in locations such as Chimoio which are inaccessible for local litchi growers, and feeds new knowledge to them about best practice.

Joqim is another successful farmer with land in the area of Nhamuzarara I and is the son of the secretary of neighbouring Localidade, Makosa. Joqim started cultivating litchi in 2011 when he was given 50 *shartia* by Batiste who also instructed him on the planting and caring of the trees. The following year Joqim received 104 more *shartia* from Westfalia and now has over 200 trees. He produces *shartia* which he sells for 100 MZN but most commonly uses as a means of paying for labour. This year he has given 15 to Natoria, his neighbour, and 20 to Pauline, his brother-in-law, who have been working on his land. In addition to tutoring these labourers on growing the trees, Joqim has made follow up visits to their farms since they planted their litchis to ensure they are doing well. Upon a recent visit to the farms he found the trees were not growing at a healthy rate and noted that neither were using mulching to retain moisture at the base of the trees. He instructed them on mulching and since the trees have been growing much healthier.

Between barriers of access to water-rich land, the capital required to become a litchi grower and knowledge on how to do this, entering into ILP is not simply something all farmers can do, should they have the right motivation or mindset. Rather, it is something only specific farmers are able to achieve, the characteristics of which are discussed in the following section.

6.3. Characteristics of farmers

Amongst those farmers who have successfully managed to engage with ILP in Inhazonia there is such a degree of diversity in terms of superficial characteristics that would make characterising the ‘typical’ litchi grower in terms of such traits redundant. Those successfully commercially producing litchi were found to represent a wide range of different ages, genders and socioeconomic classes and so forth. Contemporary literature on innovation has shifted the focus away from such extrinsic factors of not only individuals, but also innovations themselves and the environment in which they are implemented. Attributing greater deterministic value to the intrinsic characteristics of individuals, literature now shows a greater appreciation for the perceptions of individuals or their worldview as a means of explaining the spread of innovation in communities. The findings of this research indicate that such intrinsic characteristics are not a crucial determinant of the nature in which ILP has spread in Inhazonia, however. The most important factor which describes this process and who engages with it is the degree of political and social connection of given individuals in the community.

Taking the two presidents of the Nhamuzarara I & II growers association as an example, Anita is an elderly woman from a respected family, while Batiste is an uneducated former military man. These individuals have established themselves as two of the largest and most successful farmers in Inhazonia, possibly only secondary to Peter. Anita and Batiste therefore serve to illustrate those characteristics which are important as much as those which seemingly are not. Anita has benefitted considerably from



her social connections, most specifically her kin network, being daughter of the first man to claim land in Inhazonia. Besides affording her access to prime, water-rich land, the social standing and local importance of her now deceased father has conferred on her a similar standing. Through owning such vast quantities of land she also has political power and has established connections through this, being approached by Peter when he first came to the area and needed land. Batiste on the other hand does not come from such an affluent or well-respected background and did not complete his primary education. He managed to establish political links through serving in the state army and established social ties to Peter through working for his father while in Zimbabwe. These are just two examples of farmers in the area who come from very different backgrounds, albeit two of the more successful cases, who have managed to use social and political connection to circumvent those barriers listed in the previous section, rather than being similar through other characteristics.

This understanding of which farmers are able to engage with litchi and which farmers tend to be excluded contrasts heavily with the narrative of 'vision' common in the area and complementary ideas around individual accountability and mindset. The expansion of litchi has been much more exclusionary than such discourses would suggest and is not something that is accessible to any farmer who has the right mindset or is motivated enough. Indeed, 'vision' as described above is more a grandiose way of describing individuals who are less vulnerable and can therefore afford to take larger risks, be that through financial stability or the support of well developed social networks. Anecdotal evidence of 'visionary' actions taken by farmers in Inhazonia are actually instances of individuals with the financial and social capital to take risks that less advantaged and more marginalized people simply cannot afford to make. Consider the example of the farmer who stored maize following the harvest to pay workers, who will invariably be hungry during the lean period of the year. While this is undoubtedly an intelligent move, it is only possible for someone who a) has enough food that they can side-line some of their produce and not risk starving b) has enough money that they do not need to sell their produce to support their household c) can afford the costly chemicals required to treat the maize such that it can be stored and not rot or succumb to pests and d) has access to a secure facility where the maize can be stored and not plundered by thieves. As discussed in the previous section, socially connected individuals can often circumvent such boundaries through arranging access to necessary resources through family and friends.

One extrinsic characteristic which was found to be relatively common amongst farmers who have entered into commercial litchi production was a high degree of migration between Mozambique and Zimbabwe. With histories of conflict, oppression and economic struggle in both countries there is a long history of migration between the two states. One possible explanation for the level of migration evident in 'more innovative' farmers could be that for those who fled Mozambique as economic refugees, through opportunities in Zimbabwe they became more affluent than those who remained behind. Upon returning to Mozambique with financial capital and experience in new practices which they observed abroad, these farmers were better equipped to employ innovations on their farm. This theory is supported



by the fact that many farmers in the area reported that agriculture in Zimbabwe is generally more advanced and that they gained experience in a wide range of different practices while employed there. A second possibility is that the hardships of migrating and carving out a life for yourself in another country, being self-sufficient, instils a certain drive or motivation in farmers which endures when farmers return home. As one local farmer who spent decades in Zimbabwe alone explained, moving away from your home country is an extremely challenging experience and it is hard to survive on your own. Such an experience could cause a farmer to be more willing to take risks on their farm, implementing new methods and constantly trying to improve when they return home. Alternatively, the same could be true but more so a case of correlation rather than causation. In terms of economic refugees who would migrate and be expected to send remittances back home to their family, it makes sense to send the family member who has the greatest potential when funds for making the move are limited. As such, migrants would tend to be the more hard working, motivated or highly educated individuals who would make the most money for the family at home. When faced with a dearth of opportunity and finances, what chances are available are offered to the most promising. While each of these factors contribute to greater and lesser extents in each specific example, together they count towards explaining observed overlap of migrants and innovative farmers. Finally, individuals who travel tend to have more widely distributed social networks which means they can access resources distributed over a wider area, as exemplified by the farmers who access cheaper pipes in Harare through family there.

Accessing the resources required to engage with ILP and having the capacity to take the risks necessary to do so are greatly aided through political and social connection in Inhazonia and this degree of social connection is the most unifying characteristic amongst litchi producers. Examples of individuals who have used such social and political connections to engage with litchi production are exhaustive. Arguably those who have benefitted most have utilised connections to political figures to gain benefit from development projects. Subsequently other farmers have laboured for such individuals to acquire *shartia* and access knowledge on how to care for them. Individuals are negotiating access to canals and, in certain instances, constructing their own to support these trees using knowledge from family and friends. These networks allow people to access vital resources and, as such, minimise the overall risk required to start ILP.

6.4. Preliminary conclusions

Local development actors and prominent farmers in Inhazonia suggest that those who have succeeded in becoming commercial litchi producers have achieved this through their distinguished mindset and inherent 'vision', but this is not the case. For both the spread of innovations in irrigation and those related to litchi, the initial phase of this spread was concentrated in the hands of a small band of elite almost exclusively in Nhamuzarara I & II who were directly connected to Peter. This flow of benefits had all the hallmarks of a patron/client relationship, where exchanges between specific 'patrons' and their 'clients' are personalised in nature. Patrons and clients are distinguishable by status, power, wealth



or some other characteristics, with the patron the superior member and the client the inferior (Khan, 1998) Such patterns of exchange can facilitate elite capture, a phenomenon whereby a group of individuals who have superior political or economic status relative to others in their social cluster manage to manipulate and channel some flow of resources, often to the detriment of others in the cluster. In patron/client relationships, elites, constituting the clients, manage this through the provision of financial or political support to a patron. Typically, this kind of relationship is used to describe exchanges in countries between corrupt state officials and privileged groups of clients, yet such relationships can express themselves in various arrangements. As they heavily influence the flow of resources and benefits, patron-client networks are also extremely pertinent in terms of development interventions. Authority in rural Mozambique does not conform to standardised ideals of formal governance and is often found in decentralized, traditional or kin-based authorities whose role and power can be difficult to fully comprehend, especially for an outsider.

Peter's role in Inhazonia certainly appears to fit this description, with his political power exemplified by the large land holdings he procured upon arrival in Inhazonia and his capacity to direct the resources of Westfalia and ARA Centro (a state body) towards the cause of litchi production in the area. Important to underline here is that not all patron-client relationships are motivated by corrupt dictators or malign predators. Peter is widely revered in Inhazonia and no evidence of tithes on litchi profits or other financial demands were observed during the course of this research. Indeed, his actions in the area have acted as a crucial catalyst for considerable development and appear to be a force of positive change in the area. Nonetheless, the early expansion of ILP in Inhazonia has a distinctive character of elite capture about it, which was further compounded with the arrival of the development actors from Maputo, whose resources he funnelled towards this core group.

To an extent, these processes are motivated by social connections with those who have benefitted the most from his assistance, with Batiste being a friend of his late father, for example. Yet in line with patron-client theory, one must consider what greater benefit Peter receives as patron in exchange for this service. As previously described, there is no evidence of financial benefits flowing to him from his clients, and the success of his commercial venture would not warrant such compensation. To a certain degree it appears he is genuinely motivated by concern for the strife of people in the area and a desire to eradicate poverty. More in line with patron/client relationships, it appears he is also consolidating his political power and social standing however. Through his work in the area, he has been afforded the title 'living national hero' by the President of Mozambique. He has also recently pledged 6,000,000 MZN to the construction of a public swimming pool in the area. His work in the area has made him a local hero in addition to his formal title of 'national hero', a strong foundation for anyone with political aspirations. As such, he transcends the traditional construction of the malevolent patron exerting control over vulnerable or weak persons.



While concentrating benefits in the hands of a small band of connected local elite, his interventions also laid the necessary foundation for the subsequent developments which have seen farmers in the wider community engage with ILP. This process is more inclusive in its nature in that it isn't predicated on access to one patrimonial source of authority or external development projects and isn't concentrated in a group that is distinguished from their peers on economic or political power. Nonetheless, this subsequent expansion is still predicated on access of sorts as social connection to members of the local litchi elite is one of the easiest ways for such farmers to do so.



7. Discussion

7.1. Lessons learned from the spread of irrigated litchi production in Inhazonia

The objective of this research was to better understand the social dynamics which underpin processes of farmer-led development by following the spread of agricultural innovation in a rural Mozambican community. An important point of departure for any such discussion then is an examination of the extent to which the current spread of ILP in Inhazonia, the case study through which this was achieved, actually constitutes farmer-led development. Returning to the definition of farmer-led irrigation development as “*smallholder irrigation that is initiated, operated, maintained and usually constructed by local people, using local materials and ideas*”, we can analyse the spread of irrigation in the area to date using these analytical criteria to determine to what extent this has indeed been farmer-led. Central to this definition is the term ‘local’, which is somewhat open to debate yet has a considerable bearing on what is encompassed in the term ‘local materials and ideas’. In terms of the canal and furrow irrigation which is the backbone of this expansion, such systems are evident in the area as far back as the beginning of the 20th century when those fleeing harsh conditions in colonial Mozambique and then-Rhodesia settled in the area due to its remoteness and water richness (Bolding et al. 2010). In terms of the physical materials used, this main form of irrigation infrastructure requires little more than shovels to implement. Some would challenge the degree to which the pipes and pumps used by some farmers can be described as ‘local materials’, but this is due to a misguided conflation of the terms ‘local’ and ‘traditional’, resulting from discourses which portray farmer-led irrigation development as backwards. The boundaries that apply to processes of farmer-led development are not so much about the level of technology used but rather about who is driving the process. Regardless, such materials are sourced, at furthest, in neighbouring Zimbabwe. One could argue against regarding a separate country as ‘local’, but abstract constructions of national boundaries by colonial powers are taken here to be less pertinent than the interwoven history and long-standing relationship between farmers in the east of Mozambique and Zimbabwe. Therefore, in terms of the materials and ideas which have driven the this irrigation expansion, they certainly meet the criteria of farmer-led development included in the above definition.

When looking at the former part of this definition, which describes “*smallholder irrigation that is initiated, operated, maintained and usually constructed by local people*”, it becomes necessary to once again distinguish between the two phases of the spread of irrigation in the area. In examining both the initial spread to the small elite of Nhamuzarara I & II and then the subsequent phase of expansion into the wider community using this lens, while the latter phase meets these criteria, the former does not. The initial phase of expansion was predominantly initiated and driven by Peter with considerable support from Westfalia and ARA Centro. While the local farmers did operate and maintain the irrigation infrastructure that was implemented, to claim they were mainly responsible for its initiation and construction would be misguided. Rather, this process was mainly driven by external actors. The subsequent expansion has been driven by farmers seeking out the knowledge of others with experience



in constructing canals, saving and purchasing their own pipes and pumps and negotiating access to pre-existing canal systems. This process has a distinctly bottom-up character and meets the criteria outlined above. To determine to what extent the broader expansion of ILP, rather than solely the expansion of irrigation in the area, has been farmer-led, the same distinction proves useful. Taking farmer-led processes to be bottom-up in nature and driven predominantly by farmers in the presence of minimal interventions from outside actors, the initial phase of litchi expansion cannot be regarded as such. The current phase of expansion is being driven by the farmers themselves however, with knowledge being transferred from farmer to farmer through social networks as outlined above. It is the farmers who are investing their own time, money and labour into engaging with such practices. As such, what insights this research provides into the social dynamics that underpin processes of farmer-led development must be gleaned from this latter stage of ILP in Inhazonia.

Positioning this study within broader research in this area, these findings do not support the process of social learning as it is often represented within existing work on the topic (Besley & Case, 1994; Foster & Rosenzweig, 1995; Munshi, 2004). Such literature represents communities as a type of unified body engaged in collective experimentation. This idea of social learning describes farmers observing the results of one another's experience with new technologies and incorporating this into their decisions regarding next seasons cultivation. This type of social learning has not been characteristic of the expansion of ILP in Inhazonia however, which is better understood as more exclusionary learning in pockets. The role of 'learning by seeing' or simple observation is limited by the highly specialised nature of methods and knowledge needed for litchi production as opposed to other crops, along with the prerequisite resources of *shartia* and irrigation. Simply observing a fully-grown litchi in a field and deciding to engage in ILP is not a realistic prospect. As such, these innovations were found to spread through much smaller social networks of individuals with strong social connections to one another: predominantly family and friends/neighbours. Such findings resonate with research in the northern region of Mozambique examining the spread of sunflower growing. Similar to Inhazonia, farmers' propensity to take up the practice was found to be correlated with family and friends, less so with those of the same religion and uncorrelated with the wider community (Bandiera et al., 2006). Therefore, the findings from Inhazonia may also be attributable to the importance of these social relations in Mozambican society. The same paper found less vulnerable farmers are more likely to adopt a given technology, but the socioeconomic status of a farmer and their financial mobility were found to be truly secondary to the degree to which an individual's social network was developed in Inhazonia. While having greater access to capital is a clear benefit, farmers from disadvantaged backgrounds who were socially and politically connected were seen to use their social capital to circumvent the barriers that face every farmer who wants to engage with litchi production. Therefore, while theoretical and empirical literature both point towards risk as being a key determinant of a farmer's propensity to adopt new agricultural technologies, especially in Africa, this research would indicate that social capital can

often minimise risk. In Mozambique in particular, where patrimonial power structures are crucial in distributing aid and resources, this is especially significant. Probably the most interesting finding of this research however, is that the current spread of ILP in Inhazonia, farmer-led in its nature, is predicated on the patron/client networks which initially established the industry in the area and concomitant elite capture. While the farmer-led expansion of ILP is now mostly spreading through horizontal links between farmers, this current stage of expansion is reliant on the vertical social links that exist between the initial band of elite on the low-lying slopes of the Sierra Chôa and Peter.

This fact does not bring into question once more whether the current spread of ILP in Inhazonia is farmer-led in nature, which was established above. Rather, it raises interesting questions about the relationship between processes of elite capture and patron/client networks, one on hand, and processes of farmer-led development, on the other, which would traditionally be conceived as juxtaposed to one another (Islam et al., 2011). In a country where state institutions fail to meet the needs of the impoverished rural masses, shackled to subsistence and smallscale agriculture through limited access to inputs, new technologies and credit, what role can such patron/client networks play as catalysts for subsequent farmer-led development? Looking specifically at the case of Inhazonia, Peter's arrival to the area in the 1990's marked a considerable injection of knowledge and capital to the local area and his political connections attracted valuable investments of resources from Westfalia and ARA Centro. Despite the exclusionary nature of early development and elite capture that characterised this process, over 25 years since his arrival in the area, the benefits of the development he initiated are now percolating into the wider community through processes of farmer-led development. With such a dearth of economic prospect outside of smallscale agriculture and limited capacity to make large profit in the sector in Inhazonia, the lucrative commercial litchi industry, as established by Peter, is the largest driver of development in the area today and a route which people are using to escape poverty. Clientelism has traditionally been cast as an enemy of development however. Peter and Inhazonia is but one case, arguably exceptional in terms of how constructive and in terms of positive impact, of a phenomenon which has been described as a 'lethal clog in the wheel of developmental strides in most countries of the world today, particularly Africa' in literature (Endurance & Oluchi, 2018).

The results of this research do not warrant the prescription of patron-client networks as a solution to the developmental barriers facing Mozambique or, more broadly, states with failing institutions and high rates of poverty, but rather justify a discussion of the potential of such systems to foster development. Any discussion of the prospect of such patrons to act as partners to aid organizations or non-governmental organisations (NGOs) should be prefaced with an acknowledgement of the myriad moral and ideological issues such an idea inherently entails. One of the most glaring of these considerations is the provision of support, be that financial or otherwise, to an informal or unrecognised authority figure by foreign development agents. Considering the history of colonial rule in the global south, most notably in Africa, this kind of intervention could arguably be perceived as a form of neo-colonialism, subverting

traditional authority and directly establishing power over communities or regions through collaborative patron figures. The underlying motivations of NGOs active in Africa have been queried, with allusions to such malign objectives, as far back as 1994 when an issue of *Africa World Review* published an issue titled ‘NGOs and the Recolonisation Process’ (Hearn, 2007). In referring to the history of power relations between Africa and the north, the issue pointed towards development work as a modern strategy of global northern control over the continent through NGOs exerting power over local populations. Therefore, any move towards supporting patrons who embody informal forms of authority or advocacy of patron-client networks as a development tool is morally fraught.

However, development interventions can, and often do, still serve to legitimise and consolidate different forms of informal authority, albeit unintentionally. External actors commonly establish contact with communities through authority figures who sometimes represent traditional and informal forms of authority, be that state recognised or otherwise, and other times, patron figures. Establishing contact with a target community through such gatekeepers is necessary to legitimise the presence of the external actors and gain access to the local population, but in doing so acknowledges the claims of such individuals to authority which can confirm such claims in the eyes of others. In doing so, development interventions can also serve to cement the authority of these individuals by placing them in a position whereby they can develop patron-client networks based on their power to direct aid, hence supporting elite capture. The channelling of aid through such individuals is generally considered to be a more ‘fair’ or ‘safer’ means of supporting development though. As described in Buur & Kyed (2006), this is particularly true in Mozambique, a country devoid of effective state institutions which represent and support the masses. In light of this context, academics have celebrated the democratic potential of informal authority structures, leading donor agencies to increasingly partner with local and community-based sources of governance as a means of distributing aid. Recognising and partnering with informal authority figures as such invariably consolidates the power of such individuals. Because something exists presently or in the past is not a justification for its existence in the future, however. Rather than justifying the pursuit of feasible ‘patrons’ to support as a means of driving development, this argument more so serves to contextualize the idea within contemporary normative development interventions.

Besides notions of equity, state corruption and democracy, such decisions are also often motivated by the simple fact that local people know more about the local area. Partnering with local figures of authority provides external actors with crucial knowledge about the local area and people which is necessary for project implementation. The dilemma arises here again, how to balance the incorporation of local people’s ideas and knowledge into projects while preventing elite capture. Such tensions were apparent in the rollout of the APSAN-Vale project, where local authorities were necessarily consulted for advice on whom to enlist as project participants, requesting successful and motivated individuals to serve as demo farmers at field schools. After interviewing 25 farmers, project staff further consulted the local chief to confirm their selection. At this point they discovered that a considerable portion of the



farmers selected, mostly from Nhamuzarara I & II, were directly related. Project staff then refocused their attention on the village of Mutangadzi, conducting further interviews to diversify their selection. This example illustrates how development aid continues to be funnelled to the politically and socially connected farmers in Nhamuzarara I and II who are generally already commercially successful at this point. The example also illustrates how well connected these individuals through strong family ties, supporting the other finding of this research that innovations travel in small close-knit networks. It also demonstrates the dilemma facing development projects, balancing a need for local knowledge, to serve the actual needs of the people and try to help those who need it most, with the potential for elite capture.

An example from Inhazonia perfectly illustrates how development interventions, without local knowledge can serve to undermine processes of farmer-led development or contradict other processes of development in an area. As discussed under Section 5.3., local farmer Sebastião discussed the prospect of building a dam with some neighbours towards the end of last year and they formed an association of sorts. Orchestrating the organisation of the build, with knowledge of the materials required, having identified a viable location for the dam and estimating the cost of the venture, Sebastião was the main driving force behind this farmer-led irrigation development initiative. The price had been discussed and agreed with neighbours and the preliminary plan was to have saved enough money from the maize harvest to construct the dam before the end of the year. Partnering with Sebastião as a ‘model farmer’, the APSAN-Vale project offered him a diesel pump and pipes on credit to develop an irrigation demo plot. The initiative for developing the dam has now been lost and, while Sebastião himself is not left worse off, four other farmers have lost out on the opportunity to enhance their own irrigation capacity and gain knowledge on the construction of dams. Such specific knowledge may not even be available to local authority or patron figures, but underlines the importance of local knowledge in the implementation of development projects such that local processes of farmer-led development are not undermined.

The potential patron-client networks to serve as catalysts and sustained drivers of change in development, but also in the specific context of Mozambique, is a matter for debate. By definition, such networks entail a certain degree of elite capture, with the clients within such networks benefitting from the political, social or financial power of the patron. In the specific instance of Inhazonia however, such networks have stimulating the induction and expansion of a vibrant commercial litchi industry which is making significant impacts to the livelihoods of local farmers. While patrons are typically cast as malignly intentioned or self-motivated, instances like that of Peter in Inhazonia force us to reconsider these commonly perpetuated ideas. While the manner in which his resources were channelled to so few constitutes elite capture, 25 years on these benefits have spread to the wider community and are, even now, spreading further through processes of farmer-led development. As such, this research raises some questions which could be elaborated upon through further research.

7.2. Further research

The findings of this research warrant a re-examination of the role of patron-client networks in fostering development and how, in certain instances, they can inject resources into communities that subsequently spread through farmer-led processes of development. An initial point to address here is the more nuanced aspects of such arrangements and an understanding of the variety encompassed in the blanket term of ‘patron-client’ networks. A central component of any such investigation will centre on the vast range of individuals who inhabit the role of ‘patrons’ in such arrangements and how they came to inhabit their current position. Such studies would benefit greatly from complimentary research into more ethical discussions on whether supporting such arrangements is morally justifiable and, if deemed to be so, practical discussions on how this could indeed be achieved. Finally, research into how to better interweave elite capture and farmer-led development, as observed in Inhazonia, to lessen the lag period between initial intervention and its percolation into the wider community would also greatly assist in this field.

7.3. Recommendations for development projects

The findings of this research lend themselves to recommendations for development projects broadly and some more specific recommendations for the APSAN-Vale project. Beginning with those specific to the APSAN-Vale project, the findings of this research support their observation that in processes of farmer-led development, the innovation of interest can usually be sourced back to an individual farmer.

The insights this research provides into the specific channels through which knowledge transfer occurs in Inhazonia supports interventions which centre around farmer field schools and demo plots. Knowledge transfer occurs in highly localized networks of family and friends/neighbours and, as such, is quite limited in the absence of such platforms. While this may be partly due to the highly specialised nature of innovations pertaining to litchi, similar studies from Mozambique yield similar results. Great attention needs to be paid to the recruitment of farmers who are selected to host demo plots however. Effort needs to be made to ensure that there is as minimal degree of overlap between such individuals as possible, particularly avoiding members of the same family. As the networks through which knowledge will be transferred from these individuals to others are already reasonably limited, overlap between the social networks of demo farmers would be highly detrimental to project impact.

The APSAN-Vale project should also be considerate of the context of party politics and history of elite capture of Inhazonia and be conscious of recreating these trends through participant selection. This presents a unique challenge to this project as at its crux is the implementation of farmer field schools where ‘innovative farmers’ will impart their knowledge on members of the wider community. This research supports this kind of intervention, which can serve as a means to spread innovation to individuals outside of the family and friend/neighbour networks of such individuals, which knowledge transfer is usually confined to. A point of concern is that, due to the history of elite capture in the area, these individuals who tend to be ‘more innovative’ are those who are socially and politically connected.



At the same time however, it is successful farmers with the best methods who have the most to offer to the wider community. Similar to how elite capture in Inhazonia has led to farmer-led development, the same can also be true of the APSAN-Vale project, if concerted efforts are made to involve more marginalized members of the wider community in the project more broadly. As such, it can not just be assumed that demo plots run by participants will reach the wider community, rather the findings of this research contradict that assumption and show that this would lead to a slow spread of innovations through small clusters of connected individuals. Inviting individuals who are less politically active and less socially connected to the more successful farmers in the area is the most promising route to spread knowledge.

More broadly, this research further underlines the need for an understanding of local context to be factored into the design of development interventions. This ranges from understanding the history of development work in the area, to understanding how ideas and knowledge spread to more nuanced point, all of which serve to maximise the impact of the intervention and ensure that future work does not undermine previous interventions or, indeed, undermine processes of farmer-led development themselves.

8. Conclusion

With over two decades since ILP migrated from the former colonial plantation into the wider community, the spread of these innovations has seen distinct phases which constitute different forms of development. The latter, and current, phase of expansion is notably bottom-up in character and the spread of both the innovations directly related to litchi production and those of irrigation are simultaneously percolating into the wider community in a fashion that is farmer-led in nature. Knowledge and other resources associated with these innovations are generally spread through tight-knit social groups of individuals with strong social ties. The role of social learning through observation or social learning through transmission to other members of the wider community by farmers with experience in a given innovation was found to be minimal. The highly specialized nature of knowledge associated with these innovations and the physical prerequisites of access to land, water and *shartia* make implementation after mere observation unrealistic. these results resonate with other research from Mozambique however, indicating that innovations generally travel through small networks of highly connected individuals.

While key development actors characterise those farmers who have successfully managed to engage with ILP as ‘visionary’ individuals and conceptualise barriers to entry for these specific innovations to be more of mindset than the material world, this was found to be misguided. In reality, the aspiring litchi producer faces a range of considerable barriers which do not pertain to their mindset but rather their access to a range of resources and assets. Most fundamental of these is access to land which is water-rich as litchi are a notoriously water intense crop. Furthermore, farmers must have the financial capacity



to be able to afford the upfront cost of *shartia* and irrigation infrastructure, with no guarantee of financial returns for at least four years. Even for those farmers who can surmount such obstacles, the highly specialised nature of ILP, especially when contrasted against other common types of agriculture in the area, makes growing litchi without the guidance of an experienced grower extremely difficult. Only when farmers can access such resources of water-rich land, capital and knowledge does entering into ILP become a viable option – and an enticingly lucrative one at that.

Understanding and appreciating such barriers is an important step in furthering commercial litchi production in Inhazonia and fostering its expansion in a manner that is more inclusive of marginalized and disadvantaged farmers. Whilst the myth of ‘vision’, attributing the precarious and vulnerable position of many farmers to their own mindset and poor decisions, persists in development, those most in need will continue to be neglected in favour of those who ‘have shown initiative’, are ‘motivated’ or ‘have the right mindset’. Evidence from Inhazonia indicates that those farmers who are currently the most successful, those most ‘innovative’ farmers, are not distinguished from their peers in such a fashion, rather they enjoy high degrees of social and political connection which have allowed them to circumvent the barriers to entry listed above. For those large-scale and commercially successful farmers nestled in the foothills of the Sierra Chôa in Nhamuzarara I & II and those others who have worked for Nzara Yapera, they have benefitted greatly from their personal connections with Peter through elite capture. Beyond being able to access *shartia* and receiving guidance on how to grow the trees, these farmers received considerable aid from Westfalia and ARA Centro who imparted thousands of *shartias* on farmers in the area and gave advanced pipe and pump infrastructure. It was through these repeated processes of patron-client exchange that these farmers rose to the top of Inhazonian agriculture, not through some inherent quality of ‘vision’.

Through horizontal social networks, the innovations which these farmers have gained access to through connection to Peter are now percolating into the wider community as outlined above. In processes of farmer-led development, small and highly connected networks of mainly family and friends/neighbours are sharing knowledge and other resources. While the exchange of *shartia* and concomitant knowledge for labour is common practice, in the economically parched area of Inhazonia, such employment opportunities are found to be concentrated almost exclusively in the hands of individuals who comprise these two social groups for employers. Those who are incapable of engaging with litchi production are those on the fringes of Inhazonian society who do not have the financial capacity to surmount the risk associated with entering the industry and do not have the social or political connections to minimise this risk or access other crucial resources. These individuals are not devoid of ‘vision’ but rather social capital. This research supports intervention developments which incorporate farmer field schools into their design as they provide a crucial means of transmitting knowledge beyond these close-knit social networks and fostering social capital amongst the wider community. Attention must be paid to the organisation of these schools to a) not further cement elite capture in the area and b) make concerted

efforts to involve more marginalized members of Inhazonian society to increase impact and, again, not just concentrate benefits in the hands of the same few who persistently are benefitting from development interventions.

The processes of farmer-led (irrigation) development which have underpinned the expansion of litchi in the area offer valuable insights for future development interventions as such, but also open up the debate on the role of patron-client networks to foster development in countries devoid of effective state institutions. The current spread of ILP, farmer-led in its nature, is predicated on the processes of clientelism and elite capture which began in the 1990s with the arrival of Peter and establishment of Nzara Yopera. The injection of resources which these processes represent were a vital catalyst for change in the area. The question that must be addressed then is, in the absence of state support, can such patron-client networks serve to drive processes of development which can eventually transcend exclusive boundaries of elite capture and foster farmer-led development?



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10. Appendix

10.1 Initial interview guide

Thank you for taking the time to do this interview today, I really appreciate it. Just to introduce myself again, my name is James Platt and I am here doing research as part of my studies at Utrecht University in the Netherlands. I am studying International Development, so I am not an agricultural engineer and my studies focus on how people and countries develop.

My research is looking at how knowledge transfer happens in communities and how farmers learn from one another. I am interested in talking to you and getting your opinions on these things so that your ideas can be used when projects are being planned in the future. By using your opinions and knowledge, projects can be designed to help you and other farmers in the most effective way. I will be using the information you give me to write a report when I return to the Netherlands. I will not be giving out any seeds or other inputs however. If you are still happy to do the interview, we can start now, and if you have any questions for me now or at any point in the interview please just ask.

1. How old are you and how long have you been a farmer?
2. Since beginning farming X years ago, have you ever worked as a labourer on another person's farm?
3. Do you own any other gardens or mashambas in a different community?
4. Have you ever owned gardens or mashambas in a different community in the past?
5. How big is this garden?
6. How long have you been farming on this garden?
7. Do you work on this garden alone, or do you share it with another farmer?

To continue I would like to ask some questions about the types of crops you will grow this dry season here in the garden and also how you grow these plants. I need to restate here that I am not an agricultural engineer, so I do not know much about farming. So when explaining your farming practices to me, explain as if you were explaining to a baby who knows nothing about farming, no detail is too small and if I make any mistakes in understanding what you say, please correct me

8. What crops are you going to grow this dry season?
9. Have you already planted these crops? (if no, when will you plant them?)
10. How do you prepare the garden before planting? (tilling by hand, animal traction, burning, weeding)

Ask questions per individual crop

11. How do you plant the seeds, once ready? (mulching, spacing, manure, how many seeds per hole?)
12. Once planted, how do you irrigate the plants? (bucket, pump, sprinkler, how often?)
13. What else do you have to do to take care of the crops while they grow? (fertilisers, pesticides, weeding)

That was very informative and helpful, thank you for explaining everything here to me! Now that I have an understanding of what will be growing in your garden over the next few months, could we draw a map of your mashamba so I get a clear image in my mind of what it will look like here?

Draw map of garden with individual plots delineated, then depending on timing and how the interview is going, potentially ask:

14. Did you grow crop X last year?



15. When growing crop X you will do (REPEAT NOTES BACK TO PARTICIPANT), is this the exact same as how you planted and grew this crop last year, or have you changed your practice at all?
16. When will you harvest crop X?
17. When you harvest crop X, how many sacks will you be able to fill?
18. How much will you be able to a sack of crop X for at market?

That's all of my questions for today, thank you very much

10.2 Focus group guide

If a small group, we go around and ask everyone to introduce themselves (Sebastiao if needs be)

Really stress to interpreters that we are interested in nuanced details that are often revealed in the minutiae of conversations. Therefore, it is important that they do not allow people to talk for prolonged periods and then summarise this in one or two sentences, politely interrupting someone (when appropriate, important not to interrupt flow for example) is encouraged when necessary. Also ask them to take notes! This can be so that they remember when translating for us in real time but also serve as a good summary of the interview and will maybe include something glanced over while translating in real time that we can discuss after.

“Marara se!

We are Bella, Cris and James and we study in the Netherlands and are here in Mutangadzi to do research on agriculture. We are not agricultural engineers, but are all interested in people, especially here where so many people are involved in the agricultural sector. Some of you may already recognise us, as we visited the community already last week, and will be doing research here for the next two months, whilst living in Catandica. We are really excited and happy to be here, and cannot wait to get to know the community better. Even though we have come together, we are all interested in different topics, and will be conducting research individually.

Hi, my name is Bella, and I come from Australia. I am interested in learning about the way that women farm on their machambas, and learning how they gain access to their machamba, and the different ways they use them. While I am here I would really like to speak with women who work on their own machambas, and am looking forward to meeting you all.

Hi, my name is Cristina, I am from Spain. For my research, I am interested in understanding the dynamics behind machambas. Specifically, in what the materials needed for producing agricultural produce and the exchange of goods that occur. My intention is to do research in detail in 5 or 6 machambas and speak to everybody who is involved in the machamba, including the managers of the land, workers, both women and men. For that I would like to visit machambas who focus on commercial agriculture.

Hey, my name is James.....”

1. When does the rainy season last here?
2. What are the main crops that are grown here during this period?
3. During the dry season, would many people still grow crops?
4. What are these main crops grown during the dry season?
 - a. Are these crops that people eat locally or does it go to market?
 - b. Where is the nearest market where you sell these?
 - c. Do you sell to anyone else beside the market?

Relay agricultural calendar for the year back to participants and ask for corrections or remarks

5. How do you water these crops during the dry season?



6. Do many people come to Mutangaze to learn about agriculture, have researchers been here before?
7. Which people or organisations have been here before to try and assist with agriculture, teaching new methods or introducing new crops? (government or aid organisations)
8. Do you have any questions for us?

Questions to prepare which may be asked of us

1. *Why have you come to Mutangaze?*
We came to Barué specifically because its such an agriculturally productive district in Manica and for all of Mozambique. Then Mutangaze specifically because APSAN VALE are working here and people from our college in Holland are involved, so they helped us to work with them.