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Accumulation from Below

Smallholders and public irrigation investments in Kilombero Valley, Tanzania

Victor Mbande

Doctoral Thesis in Geography with Emphasis on Human Geography at Stockholm University, Sweden 2022

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Abstract

Smallholders in Tanzania and elsewhere in Africa are increasingly differentiated. This thesis contributes to the empirical and conceptual understanding of the differentiation processes in irrigation by following the internal dynamics among smallholders linked to public investments in improving smallholder initiated small scale irrigation schemes in Kilombero district, Tanzania. The aim of the thesis is to examine the role of public investments in irrigation in transforming rural smallholder farmers and how inclusive these investments are likely to be, specifically, in the current context where policies in irrigation are widely focused on poverty reduction among the smallholders. In this thesis I have used data collected from both irrigating and non-irrigating villages in Kilombero district, Tanzania so as to capture overall transformations in the area and how irrigation contributes to agricultural development and differentiation among smallholders. A combination of methods was used in this thesis, these includes participatory wealth rankings, interviews and walking interviews, focus group discussions, questionnaire survey, and remote sensing data. This thesis consists of four papers and an introductory "kappa". The study mainly problematizes the general conception within agriculture and irrigation policies that smallholders are homogenous and builds on theories of 'accumulation from above' and 'accumulation from below' to analyse development and differentiation among the smallholders in irrigation. In following processes of accumulation among the smallholders, the study links public investments in smallholders' small-scale irrigation with the processes of 'accumulation from below'.

Findings of this thesis indicate that public investment in smallholders' small-scale irrigation builds on pre-existing social differences among the smallholders. In all sub-cases in Kilombero, initial development of irrigation was done by farmers through their own initiatives as a form of a 'farmer-led' irrigation development. These developments were mainly traced from the late 1970s to early 1980s, and attracted state investments in lining the canals later in the 1990s onwards. However, it was until the late 1990s to early 2000s where there was increased cultivation in the irrigated areas. The increase went hand in hand with neo-liberalisation of the Tanzanian economy since late 1980s and privatisation of agriculture in the area from 1998. As smallholders were responding to market stimuli and increased productivity in both irrigated and rain-fed cultivation, they became increasingly differentiated. The wealthier farmers were cultivating mostly extensively in relatively larger pieces of land, and the less wealthy farmers were combining cultivation in smaller rain-fed fields and providing labour to other wealthier farmers. Most of the middle wealthy farmers were concentrated in irrigation, and therefore investment in irrigation was clearly benefiting the middle wealthier farmers. The thesis argues that expansion of rice irrigation in Kilombero plays a crucial role in the current agricultural transformations in Kilombero as rice is both a food and commercial crop in the area. In conclusion, the thesis argues that the current investments in smallholders' small-scale irrigation are fueling processes of 'accumulation from below' which are more inclusive as they benefit middle smallholders rather than the large wealthier farmers. These findings points to the importance of focusing on smallholders' in agriculture and irrigation development for a more inclusive agricultural transformation.

Keywords: *Accumulation, social differentiation, wealth ranking, irrigation, smallholders, agriculture transformation, land use change, rice boom, progressive farmers, development.*

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Contents

1. Introduction

Walking in Ifakara town in late June and early July 2017, I couldn't help noticing plenty of rice spread on roadsides to dry up before it could be processed. This is usually the harvest period in the Kilombero valley – an area famous for its rice production (Djurfeldt et al., 2021; Kato, 2007). In Tanzania, the Kilombero district, with Ifakara as its economic and administrative centre, is placed third after Usangu and Shinyanga in rice production (SAGCOT, 2011; Wilson, 2018). The district has been historically considered of high potential for agricultural development (Beck, 1964; Jatzold & Baum, 1968), and is currently one of three key development clusters in the national Southern Agriculture Growth Corridor of Tanzania (SAGCOT). In Kilombero, SAGCOT has targeted investments in sugarcane and rice where construction and expansion of both small scale and large scale irrigation schemes, agricultural intensification, expansion of non-farm activities and construction of backbone infrastructure[1] have been proposed (SAGCOT, 2011). In practice, contrary to the initially envisioned model of attracting new large scale farming enterprises, SAGCOT investment strategy has been linked to small to medium scale operations and already existing enterprises (Sulle, 2020).

In this thesis, I focus on public investments in smallholders' small scale irrigation investments in Kilombero. Irrigation development in the valley were mostly initiated in form of gravity dependent unlined canals driven by the smallholders as a form of farmer-led irrigation development (See more de Bont, Liebrand, Veldwisch, & Woodhouse, 2019; Veldwisch, Woodhouse, Komakech, & Brockington, 2019; Woodhouse et al., 2017). Public investments were done in these farmer-led unlined canals through expansion of canals and improving unlined canals by constructing concrete weirs, intakes and lining of the main and secondary canals with support from the state donors. The Tanzanian irrigation policy refers to such investments as improvement of irrigation canals and points out that improvements targets canals with 'progressive farmers' (United Republic of Tanzania, 2010). Nevertheless, the term 'progressive farmers' may conceal differentiation among the smallholders (Gwiriri et al., 2019; Passarelli et al., 2018).

[1] According to SAGCOT cluster development projections, SAGCOT intends to expand infrastructures such as roads, rail spurs, power transmissions and substations of a total of 653.5 million dollars by 2030 in Kilombero (SAGCOT, 2011b).

There is a long history of smallholder production in Tanzania. Nearly 93 per cent of the population was estimated to be smallholder farming household units during independence in 1960s (Bryceson, 2015), and currently smallholder farming is estimated to provide livelihood to about 70 percent of the population (URT, 2017). Smallholders are both farmers, involved in producing, accumulating and trading, but also farmworkers who are to a larger extent involved in agriculture production, and some have also diversified in numerous agrarian and non-agrarian activities (Djurfeldt et al., 2018). Recent research further indicate that smallholders are significantly differentiated by income and wealth, degree of commodification and accumulation, nature of market engagement and associated dynamism (Bernstein, 2010; de Bont, Komakech, et al., 2019; Ponte & Brockington, 2020; Sulle, 2017).

Type of crops cultivated is also an important factor in understanding smallholder dynamics (Belton et al., 2017; Fischer et al., 2022; Hart et al., 1989; Sulle, 2017). The distinction between food crops and cash crops influence commercialisation process as some crops are usually used for food, other for both food and commercial purposes, while others are cash crops. Differentiation among smallholders is likely to occur during the commercialisation process as smallholders respond to market stimuli (Bernstein, 2010; D. Hall et al., 2013). This is specific in irrigation where the costs of irrigating are usually high and therefore diverse high value crops are usually preferred (Passarelli et al., 2018).

There has been a discussion on the role of smallholder production globally. The main assumption has been that smallholders in developing countries, specifically those in Africa, can imitate the dramatic agricultural growth from the 1960s in Asian countries (Evenson & Gollin, 2003; Morisset, 2012; World Bank, 2008). However, policy interventions have been focused in attracting private (large-scale) capital in agriculture and irrigation which has been widely discussed mainly within the land-grabbing debate (Bergius et al., 2018; Fairbairn, 2015; R. Hall, 2011; R. Hall et al., 2015; Scoones et al., 2019). In irrigation, the impression has also been that there should be more schemes that are initiated and supported by governments and donors (Oates et al., 2017). On the contrary, others have been sceptical as the policy interventions proposed were rather uniform and did not put the smallholders in driving seat or consider how they were differentiated (Akram-Lodhi, 2008; Fibæk, 2021; Mueller, 2011; Oya, 2010; Poku & Mdee, 2011; Woodhouse, 2012). While the mainstream interventions claim to address structural constraints within smallholders, the critics view that they fail to develop "the potential of 'small' for a strategy of African development" crucial for understanding smallholder dynamics (Elliott et al., 2007; Galaty, 1981), visible in the agrarian change through social forces associated with smallholders' differentiation, diversification and depeasantization (Mamdani, 1987; McMichael, 2012; Mueller, 2011; Ponte & Brockington, 2020; Sulle, 2017). Some have gone further to view smallholder production as a modern solution to all sort of emerging and

existing crises including food, economical, climatic, and energy (Moyo et al., 2013).

Literature have showed that smallholders are increasingly commercialized and acquiring assets overtime (Andersson Djurfeldt, 2013; Brockington et al., 2018; Östberg et al., 2018; Oya, 2007; Sulle, 2017), and are also capable of initiating and driving irrigation development (de Bont, Liebrand, et al., 2019; Harrison et al., 2017; Woodhouse et al., 2017). Central to these smallholder dynamics are the processes of social differentiation which are part and parcel of the agricultural transformations (Bernstein, 2010; Mamdani, 1987; van der Ploeg, 2018). In this thesis, therefore, I place ongoing smallholder irrigation investments at the centre of such transformations. The task here is to understand how smallholder dynamics, livelihood changes and associated social differentiation affects rural development trajectories (Fibæk, 2021; Mueller, 2011). Moreover, I draw from Cousins' analysis of the potentiality of smallholders' irrigation and Mamdani's processes of smallholder's accumulation by making a distinction of the processes of 'accumulation from below' from 'accumulation from above'(Bernstein, 2010; Cousins, 2013; Mamdani, 1987). The aim is not to advance an ideal type model in the processes of commercialization of agriculture among the smallholders, as a quest for an ideal type model in agricultural transformations may be not so useful (J. A. Yaro et al., 2017, p. 539). The view is that focusing on heterogeneity of smallholders and their processes of accumulation not only captures how they are differentiated but also how they relate with other dynamics of rural change (Fibæk, 2021).

There are different findings about how differentiation processes among smallholders occur, what are their outcomes, and what are the roles of differentiated smallholders in differentiation processes (Cousins, 2013; Greco, 2015; Mamdani, 1987; Mueller, 2011; Olofsson, 2020; White, 2018). This is as these processes of accumulation underlying smallholder differentiation are likely to differ in time and space. Social differentiation resulting from the processes of 'accumulation from above and below' could be traced from earlier work in Europe (Bernstein, 2010; Lenin, 1964). However, findings elsewhere suggests that the processes of agrarian transitions tend to take different paths in different contexts (Akram-Lodhi & Kay, 2010; Byres, 1986; Fibæk, 2021). Most important for this study within these different paths in the processes of agrarian transitions is the acknowledgement by Bernstein while analysing the development of capitalism in England, Prussia and American paths where he acknowledges that despite the external forces that influenced the agricultural transitions, there is always internal processes of class formation among the smallholders that is crucial for transformation of agriculture (Bernstein, 2010, pp. 28–29).

This study, therefore, contributes both theoretically and empirically in understanding of social differentiation and accumulation from below in irrigation agriculture in Tanzania. Using Kilombero district as a case study, I ques-

tion how processes of commercialization and modernization of irrigation agriculture are likely to occur amidst social differentiation among the smallholders. Where differentiation, accumulation or rather development as Oya describes is "both a progressive and awful process"… and in this case there are no easy answers or panaceas (Kitching, 1989, p. 195; Oya, 2010, p. 2). In this case, I focus on how inclusive public investment in irrigation are likely to be amidst the ongoing social differentiation. This is rather important given need of focusing on smallholders' in agriculture and irrigation development for a more inclusive agricultural transformation specifically when public funds are invested. Therefore, village level analysis of the processes of accumulation and differentiation are used to probe issues associated with choice of crops in irrigation, interplay between the state and the market as well as overall smallholders' dynamics and land uses in area under irrigation in comparison to non-irrigated areas.

Aims and Research Questions

In this study I examine processes of accumulation from 'below' among smallholder irrigation farmers in Kilombero river valley in Tanzania. The main objective is to understand prevailing social differentiation and internal dynamics among smallholders in irrigation agriculture in the process of transforming agriculture in Tanzania. The aim is to understand what happens when the state comes in to support smallholders' farmer-led irrigation and how inclusive the publicly supported smallholders' small scale irrigation investments are. Contextually, the need to understand social differentiation follows the current emphasis on both private capital and commercialisation of smallholder irrigation, production as the country has been experiencing more than a decade of economic growth. However, there has been a notable policy focus on large scale irrigation investment and we need a nuanced understanding of the economic interests, and heterogeneity of the smallholders. While commercialisation remains one of the main driving forces of the current smallholder dynamics in Tanzania, more specifically, this study aims to highlight how the smallholders' initiatives in irrigation interact with market stimuli and state interventions in the current agricultural transformations, and how rice as a commercial booming crop shape smallholders' irrigation development. In this case, the specific research questions guiding this study are;

i. What is the historical development of smallholders' small-scale irrigation in Kilombero? (Paper 1)

ii. How have public investments in smallholders' small scale irrigation influenced accumulation and social differentiation processes in Kilombero? (Paper 2)

iii. In what ways are the smallholders' farmer-led initiatives interacting with state policies and market stimuli in irrigation development in Kilombero? (Paper 3)

iv. What is the role of rice intensification and commercialisation in smallholders' small scale irrigation in Kilombero? (Paper 4)

Thesis outline

This study addresses the previously outlined research questions in four papers which differ in terms of their focus and contribution to the overall thesis. **Paper 1** draws on the history of the development of smallholders' irrigation in Kilombero to show the rapid increase in land use and land cover change in the irrigated areas in Kilombero compared to the wider valley. Moreover, the paper uses remote sensing data to highlight the current dynamics since the 1990s in irrigated areas, and discusses how local investment in intensification and smallholder irrigation could be rather convenient to demarcate more land for conservation in the wider valley. This is as increased land use in smallholder irrigation may reduce pressure on natural land cover such as forest being transformed into cultivation. **Paper 2** introduces both the theoretical and methodological frameworks for the study by discussing and analysing the theoretical concepts of accumulation from 'below' and 'above' and how these concepts can be used to analyse agricultural transformations and social differentiation among the smallholders in Kilombero. Methodologically, participatory wealth ranking was used to show how different socio-economic groups relate to increasing social differentiation among smallholders. I developed this paper earlier than other papers and therefore it helped me to understand the prevailing smallholders' dynamics in Kilombero which points to the central role of smallholder irrigation in the current agricultural transformations in the area. **Paper 3** analyses policy efforts in Tanzania that tend to prioritize transformation through private (large-scale) capital rather than small-scale smallholder irrigation. In this case, the paper diverts its focus towards public investments in village-level smallholders' small-scale irrigation and show how the word 'tija', a local discourse of progressiveness, is widely used in the current efforts to commercialize rice production through irrigation, but also closely linked to emergence of the so called 'progressive farmers' as a desired development outcome of irrigation policy. Building on the literature on farmer-led irrigation development, the paper further analyses a case of both farmer-led

and state supported irrigation, where farmers initiated irrigation development by digging unlined canals which attracted state supported investments in lining and expanding the canals. Generally, the study shows how state interventions can improve farmer-led initiatives and influences aspirations for progressiveness as the smallholders interacts with both the state and responds to market stimuli. **Paper 4** is focused on a question of a rice boom in Kilombero and aims to look closer on how a domestic, smallholder driven rice boom looks like. Regulations on rice irrigation were perceived to carry a connotation that 'if you irrigate it has to be rice'. Increased mechanisation that is partly driven by investment by differentiated farmers, and demand of rice for domestic consumption in Kilombero plays out in the process. Moreover, the paper discusses how smallholders offer a domestic response to a 'rice boom' in Kilombero and why processes of 'accumulation from below' and micro-level dynamics are crucial to understand in relation to larger-scale crop boom politics and price dynamics.

Overall, the four paper provide an insight of the ongoing irrigation dynamics and social differentiation in Kilombero which are driven by both smallholders as they interact with the prevailing market forces with both support and regulations from the state. Based on this the thesis indicates that public investments in smallholder rice irrigation that are driven by smallholder farmer-led initiative are more inclusive and linked with progressiveness amidst the internal differentiation among the smallholders in Tanzania.

2. Inclusion and differentiation in smallholder irrigation

The renewed interest in agriculture prior and immediate after the rising food prices in 2007-2008 signals optimism in agricultural performance and revived potentiality of agriculture transformation of smallholders production in developing countries (Deininger & Byerlee, 2011; World Bank, 2008). Recently, studies on irrigation investments in Africa have also identified a huge potential in different types of smallholders' irrigation (AU, 2020; Xie et al., 2014; You et al., 2015), with other studies suggesting that smallholders' small scale irrigation has the potential of outpacing the use of large-scale irrigation (Giordano et al., 2012; Woodhouse et al., 2017). However, studies have noted the continuous policy preference towards large-scale irrigation associated with claims of lack of differentiation and limited technological exposure among the smallholders in the rural (Bergius et al., 2018; de Schutter, 2011; Veldwisch et al., 2019; Woodhouse, 2012).

The focus on large scale agriculture and irrigation has constantly informed the development visions and agricultural policy interventions in Tanzania including Tanzanian Development Vision 2025, "Kilimo Kwanza" (meaning agriculture first) initiative which also informs SAGCOT, and Tanzania irrigation policy of 2010 (SAGCOT Centre Ltd, 2011; United Republic of Tanzania, 2010). These policy interventions in Tanzania encourage commercial medium and large scale farmers to bring agriculture value chains, 'modern' methods and technologies, improvement in infrastructure and generating rural employment which are projected to trickle down and promote growth of smallholders (Havevnik, 1993, pp. 24,31; URT, 2016, p. 1; URT, 1999) However, studies have discussed how large scale investments in Tanzania and elsewhere are bypassing smallholders' heterogeneity, and are associated with reduction of a total number of people involved in agriculture to imitate the developed countries one digit figures, and are associated with land grabbing (Akram-Lodhi, 2008; R. Hall, 2011; Mbunda, 2016, p. 267; Scoones et al., 2019). Consequently, policies have also focused on how smallholders could be included where out-grower models have been suggested as a way in which these large scale investments could be used to transform smallholder production (R. Hall et al., 2017; SAGCOT, 2011; J. Yaro et al., 2016; J. A. Yaro et al., 2017).

Out-growers model such as that suggested by SAGCOT in Tanzania, is seen as the future of Africa's commercial agriculture (J. A. Yaro et al., 2017). The model is one out of three broad agricultural models that are seen feasible for agrarian transformation namely; plantation agriculture, contract farming (or out-growers' schemes), and medium-scale producers commercial farming. These agricultural models are also prevalent in Tanzania where findings shows that some of large scale 'modernization' plantation projects materialized while some such as TCWP - the Tanzania Canada Wheat Programme in the 1960s in Hanang, SEKAB's *Ecoenergy* project in the 2000s have never materialized (Coulson, 1977; Homqvist, 2015). Meanwhile some of the out-growers models are currently running such as KSCL – Kilombero Sugar Company Limited, while others such as KPL - Kilombero Plantations Limited which was also endorsed as flagship projects for SAGCOT is currently not operational (Oakland Institute, 2019). This is despite the perceived importance of KPL given its System of Rice Intensification (SRI) technologies which has helped to substantially increased yield among the smallholders as some were recorded to outperform KPL in productivity per hectare, but at the same time, KPL faced critiques over competition for land (land grabbing), low salaries, limited full time employment opportunities and debts among smallholders involved as some defaulted their loans (Bergius et al., 2018; The Oakland Institute, 2015). Similar concerns are also raised on KSCL as despite its role in improving smallholder's livelihood, but there are concerns on possible land grabbing (Blache, 2018), and most importantly for smallholder dynamics and for this study, are the processes of social differentiation (Sulle, 2017).

Moreover, Yaro et al. (2017) for example reveals that out-growers' system in the Ghanaian case is not seen as disruptive as other two models (large scale and middle commercial farmers model). This is as most of the out-growers retain access to land and may choose to lease it, it provides more permanent and relatively well paid employment and income for out-growers, and ensured food security. At the same time, they acknowledge the prevalence of social differentiation specifically as female and youth loose out, skilled and better jobs are taken by a few and in most cases from outside the area, majority of the jobs that are created are basically low paid, casual and temporary (J. A. Yaro et al., 2017, p. 552). Generally, studies in Tanzania and elsewhere points towards marginalization of smallholders as a result of integration into large scale, commercial and technology intensive agriculture which is associated with dispossession of land and water resources, loss of jobs, social conflicts and social differentiation (Bergius et al., 2018; Li, 2011). The marginalisation of the smallholders brings the question of inclusion in terms of if they should be moving up or out of agriculture?

SAGCOT initiative is yet to become fully operational in Kilombero, nevertheless, it represents a distinct model of commercialization and differentiation from that driven by smallholder farmers. Therefore, in this thesis I fo-

cused on public supported investment in small scale smallholder irrigation development in Kilombero valley, Tanzania. These public supported investments were made so as to increase water productivity by improving gravity dependent unlined canals that were initially developed by the smallholders as a form of farmer-led initiatives. The dominant policy prescription for improving such smallholders' irrigation is mainly through technical (engineering) and investment in physical infrastructure such as the construction and improvement of weirs, irrigation intakes and canal systems (Lankford, 2004; United Republic of Tanzania, 2010). In this case, expansion of canals was done using public funds, mainly from the government and donors, by constructing and lining new weirs, intakes, main and secondary canals to allow water to flow towards unlined tertiary canals that direct water into the fields. This type of irrigation is distinct from other forms of small scale irrigation such as those using different types of pumps alongside lined or unlined canals or those that are dependent on manual methods such as buckets, watering cans, calabashes or merely diverting water from river streams.

In Kilombero district it was indicated that while lining of irrigation schemes in the area had started from as early as 1970s, five (5) smallholders small scale irrigation canals were already lined and working and while others (11 schemes) awaiting further investments during the period of this study (Alavaisha et al., 2019, 2021; Mcclain et al., 2016; Senkondo et al., 2018). What is interesting in the case of smallholders in Kilombero and other parts of the country is that there are notable ongoing investments in smallholder irrigation quite different from proposed out-growers' schemes and private capital investment and therefore form a potential target for modernization and scaling up.

Simultaneously, the current increased land use by smallholders and other users challenge the empty land narrative in an African context. This questions on how to obtain land to establish large scale, new nucleus farms and expansion of irrigation investments remains problematic despite their claims on green and inclusive growth (Bergius et al., 2020; Bergius & Buseth, 2019; Bluwstein et al., 2018). This has been a centre of focus of the land-grabbing critics usually questioning the accumulation from above processes mostly using Harvey's primitive accumulation theory, accumulation by dispossession (R. Hall, 2011; R. Hall et al., 2015; Harvey, 2003; Porsani et al., 2017). However, this study also intended to highlights how investments in smallholder irrigation is more likely to contribute to overall conservation practices in Kilombero.

On the other hand, focus is on how smallholders' differentiation plays out in both irrigated and non-irrigated production. Social differentiation in agricultural transformation is not a new concept, but a concept that is used differently by different theoretical approaches. In 'modernization' theory, is pointed by Van der Ploeg (2018) as mainly used to describe a market driven process

which triggers growth through mutual competition and seizing of market opportunities where enlargement of farms and new technology are typical outcomes. Those who are unable to expand and adopt to these new technologies and adopt to the market are then forced to quit and join other non-agrarian jobs or move out of the rural economy (Morisset, 2012; van der Ploeg, 2018; World Bank, 2008). This approach on one hand, has been criticized as it does not differentiate between the radically distinct needs of small as opposed to large scale farmers, and thus masking the inevitability of marginalization among farmers with a call for the "impoverished to seize market opportunities" (Havnevik et al., 2007, p. 18). Van der Ploeg (2018) further describes Social differentiation as 'demographic differentiation' whereby this is analysed from internal factors within the family farm unit as population within the household increase or decrease – thus affecting labour and farm size in different ways. For the Marxists, and for the purpose of this study, social differentiation is seen as a result of commoditization and accumulation processes which results in class differentiation where farmers are exploiting one another rather than mutually competing and where these processes are usually internal dynamics to agriculture production itself (van der Ploeg, 2018, p. 3).

Recent findings on social differentiation among the smallholders indicate that while many smallholders in Tanzania have not been able to develop into capitalist farmers, they are increasingly differentiated (Lusasi et al., 2020; Mueller, 2011; Ponte & Brockington, 2020; Sulle, 2017). Findings elsewhere in Africa have pointed out that increased differentiation in rural areas has an implication in development models that are currently targeting the smallholders including those focused on progressive/emergent farmers (Brockington et al., 2018; Fibæk, 2021; Gwiriri et al., 2019). As ssmallholders remain dynamic and differentiated, studies indicate that they are able to transform along a variation of paths where some accumulate and some are dispossessed (Akram-Lodhi, 2008; Fibæk, 2021; Li, 2014; Olofsson, 2020; Sulle, 2017). In this case, processes of accumulation from below, which implies differentiation arising from internal competition among smallholders, are typically entangled with accumulation (from above) by rural landholding and urban merchants and elite classes, as well as international investors (Mamdani, 1987; Oya, 2007, 2010; Shivji, 2009; Sulle, 2017). Nevertheless, studies focussing on processes of accumulation from within the smallholder sector and especially studies that include a diversity of small to large and poor to relatively wealthy smallholders have remained scarce (Oya, 2010), and called for in the Tanzanian context (Maghimbi et al., 2011; Mueller, 2011; Shivji, 2009, 2017).

3. Theoretical framework

Smallholders

There is no single definition of smallholders. This could be associated with the fact that there are many ways in which smallholders themselves differ in time and space depending on different stages of developments attained. The term smallholder itself is usually used interchangeably to refer to numerous types of farmers such as peasants, small scale, family, low-income, low-input, or low-technology farmers (Brüntrup & Heidhues, 2011; Watts & Bernstein, 2010). Some of the advanced definitions of smallholders are focused on size classifying them into small scale and large scale, while other are focused on economic factors such as low income and limited resources, dependence on family labour, technology used and some on subsistence nature of its production aimed at producing for household consumption (Hazell et al., 2010).

Definitions of smallholders based on size include the criteria by the World Bank's Rural Strategy, and Food and Agriculture Organisation's (FAO), which define smallholders in terms of those households with low asset base that work on land plots which are smaller than 2 hectares. These smallholders are estimated to be about two-thirds of the developing world's rural population most of them living in poverty, undernourishment and food insecurity (Nagayets, 2005; Rapsomanikis, 2015; WORLD BANK, 2003). However, distribution of farm sizes and their productivity in different localities is determined by numerous factors such as agro-ecological, demographic, economic as well as technological factors including irrigation and in this case there is no universal definition of what is or should be small as different localities are affected differently by these factors (Rapsomanikis, 2015). In an area where population density is relatively high and production more intensive a household producing on a certain amount of land, let's say 2 hectares, may be considered large compared to a person producing on an equally large parcel of land in an area with relatively lower population density and more extensive production. A good example of this could be what is described by Hazel et. al. (2007) by comparing a farm of 10 hectares in many parts of Latin America and the same size of farm in the irrigated lands of West Bengal. While this size of land is smaller than the national average in the Latin American context, it is well above the average and would in some cases be regarded as large scale commercial production in the West Bengal context (Hazell et al., 2010).

Another way of defining smallholders is that which views a smallholder as based on subsistence production. Here a smallholder is viewed to have characteristics similar to those of a peasant in how they organize their farming primarily for the purpose of household reproduction usually aimed at supplying food and other needs to the household (Bernstein, 2010, p. 3). A peasant in this case can be defined as a farmer usually in a rural area whose production is primarily for subsistence but also encompass commodity products, and who depends on the family as a unit of production (family labour) but also as a unit of consumption and reproduction, and who is imperfectly linked to regional-cum-international markets where surplus is extracted (Bryceson, 2015, p. 10). This way of defining smallholders is more focused on the type of farming and the purpose of farming for these smallholders. The role of the size of the farm in this case is not prioritised given the fact that different small farm sizes may have notable productivity differences within different contexts but also factors such as average household and rural population. It is pointed out that in Asia there is relatively lower average size of farms (a good example being Vietnam with an average of 0.32 hectares compared to 0.9 in Ethiopia and over 2 hectares in Nicaragua) most of these are irrigated and use relatively more agricultural inputs and therefore generate more income on relatively smaller parcels of land than their counterparts in Africa and Latin America who are mostly rain fed and use relatively less inputs (Rapsomanikis, 2015).

Smallholders can also be defined on the basis of family labour that they use in production, where the definition of a smallholder corresponds to that of family farms. Family farms refers to those farms that are owned, managed or worked by the family by using family labour, through a combination of some or all three characteristics (Bernstein, 2010). The view of smallholders as family farms is based on the assumption that most of the labour used in small farms is usually that of the family members, mostly women, and whenever hired labour is used, it is at a relatively lower amount and mostly on a seasonal basis. In Kenya for example, it has been noted that "on average smallholder family members provides twenty times more labour than hired labourers" (Rapsomanikis, 2015, p. 15). Prevalence of family labour among the smallholders is also associated with the low cost of family labour in most of the rural areas and the relatively smaller size of the farms. As the size of the farm increases more labour is needed which would require more capital and supervision, but at the same time if the price of labour including family labour could be increased this could imply a positive increase in rural incomes and possibly also increase mechanisation. In this case, relatively low rural wages and small size of farms allows low capital and supervision costs and overutilization of family labour in production, thus intertwining smallholders and family farms.

With the development of capitalism in different parts of the world and new global demands for agricultural products including the feeding of growing populations and needs for alternative energy, the agrarian question and spe-

cifically the inclusion of smallholders in rural growth and development processes has been of vital importance. At least two reasons have been put forward to justify this: firstly, smallholders are associated with high 'yield gaps'(which could be described as the difference between actual and potential yields), and in a Tanzanian context this is usually also linked with existence of large areas of unutilised land, dominance of smallholder production that is relatively unproductive, inefficient, and characterised by limited use of technology in Agriculture (SAGCOT, 2011, p. 4); and secondly, smallholders make up a large part of the world's poor, undernourished and food insecure population, with a majority of them living in poverty with limited access to markets and services despite their substantial contributions in feeding their populations (Rapsomanikis, 2015; Snyder et al., 2019).

Inclusion of smallholders in rural development is usually translated as resolving the problem of their limited access to markets. There are usually two main strategic questions that are raised on this aspect. These questions are: how can we help smallholders to develop into commercial and market oriented farmers, and how can we ensure that agribusiness companies reach the smallholders with inputs and technology and for the supply of farm produce. These questions have been posed in different ways among studies that have been focused on smallholders' integration into the market as illustrated in figure 1 below.

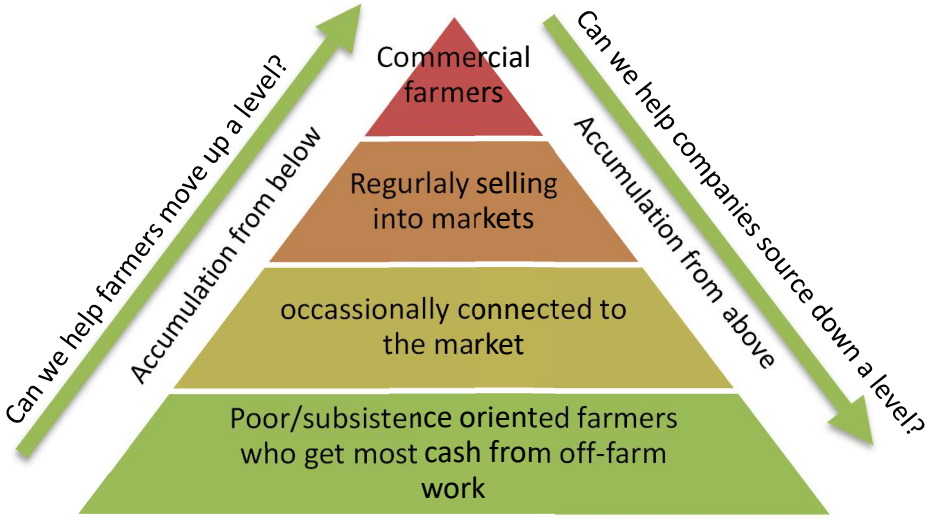

Figure 1. Smallholder Inclusion and associated accumulation processes

Source: Adapted from Nwuneli et. al. 2013; as quoted from Ferris and Seville, 2010 and Del-Pozo Vergnes, 2011

Subsequently, the first question is more focused on the smallholders themselves and how these are able to grow into more commercial farmers as illustrated in figure 1 above. What can be done to ensure that smallholder social mobility is attained in line with their increased access to the market. But central to this question is smallholder heterogeneity in terms of how they are differentiated and how these different smallholders are able to accumulate so that they could be able to invest in their production and move up the pyramid as illustrated in figure 1. Therefore, central to smallholder inclusion in this aspect is the understanding of smallholder differentiation processes in terms of on what level in the pyramid they are posed, where they are heading and what could be done to assist them to take a more feasible path(s).

The second question is more focused on factors outside the smallholders themselves. Here the focus is on the potential synergies between the large scale investors and the smallholders and in the process of linking smallholder farmers in value chains, create employment, disseminate new technologies and therefore stimulate agricultural growth and productivity of the smallholders. Here the focus is on how those from above are able to go down and capture those from below by opening up commercial and market opportunities.

In a Tanzanian context, policy initiatives focused on inclusion of smallholders in the market such as Kilimo Kwanza and SAGCOT are more focused on commercialisation of agriculture based on the second question. The outgrowers' models, where smallholders are producing on a contract basis with the nucleus large scale farm, are seen as a viable option to link the large scale investors to the smallholders. In the context of this thesis it is difficult to explicitly analyse the implications of the SAGCOT out-grower policy on smallholders given the fact that new large nucleus farms in most cases have not been established. What can be said is that the nucleus-out-grower models that have been in operation within the SAGCOT area, while also pre-dating the SAGCOT initiative present a mixed picture in terms of how smallholders have benefitted. On one hand, there are examples of dispossession of land from the smallholders, low wages, limited corporate social responsibility, vulnerability of out-grower smallholders as they fail to repay their loans and some observed complaints from smallholders over crop damages on their farms as a result of agro-chemical applications mainly through aerial spraying of these agrochemicals (Bergius et al., 2018; The Oakland Institute, 2015). On the other hand, some have shown how smallholders are differentiated within the outgrowers schemes with some accumulating and benefitting more than others (Sulle, 2017). The most interesting observation however has been that smallholders have found to outdo the nucleus farms in productivity per hectare (Bergius et al., 2018; Nakano et al., 2014).

Current studies on smallholders show that despite previous claims of higher yield gaps, income and yields per hectare is higher among smallholders compared to their larger counterparts. In Kenya and Tanzania for example "smallholders produce significantly more maize per hectare compared to the yields

attained in other farms" (Rapsomanikis, 2015, p. 12). The fact that the potentiality of smallholders' productivity always arises even in the current context where policies are more focused on commercialisation of agriculture through large scale investments suggests the need to further understands the agriculture dynamics in Tanzania and other developing countries where smallholders are dominant. This is given the fact that the smallholders themselves face a number of challenges with increased commercialisation in production as they face possible decrease in the size of their farms, possible decrease in productivity in terms of yields per hectare, slowdown in agricultural productivity growth (Rapsomanikis, 2015) and an overarching commodification of their subsistence (Bernstein, 2010). Commodification of smallholders' subsistence implies that the smallholders obtain their daily means of subsistence in the market and in this case they have to also sell their products and their labour for cash.

With the development of a neo-liberal market economy and increased economic growth in Tanzania, the smallholders are expected to be part and parcel of the world economy through agricultural commodities value chains and at the same time evolve and grow out of poverty. The inclusion process proposed for smallholders through an out-growers model leaves a lot to be desired. This is given the fact that SAGCOT is still seen as a viable model for agricultural development and a solution for smallholders' inclusion. The question of prioritising large-scale agriculture over smallholders has to take into account the potentialities of smallholders in growth but also the question of their democratic rights in terms of freedom of choices in the inclusion process.

This study therefore focuses on understanding smallholders in agricultural dynamics in the current contexts where policies are focused towards agricultural transformations mainly from above. An important aspect in this being the understanding of the accumulation processes among smallholders and possible emerging social differentiation processes in these dynamics. This takes into account that understanding of accumulation processes in agricultural development has to take into account the internal accumulation processes of the smallholders in relation to the external processes. The internal processes are important in understanding the internal class dynamics in agriculture and their role in agricultural transformation.

The concept of accumulation can be understood in line with the process of surplus appropriation in production mainly through the process of extraction of surplus value in the market. Surplus value itself is a social product, in the sense that it is essentially a product of human labour. Extraction of surplus value in the market is simply appropriation surplus labour, which is that labour in production producing beyond the need of consumption (production for use value) and reproduction of the means of production. It is in this sense that Bernstein defines accumulation as the "exploitation of labour driven by the need to expand scale of production and increase productivity in order to make profit" (Bernstein, 2010).

Appropriation of surplus in the development of the capitalist system according to Marx is inherently dynamic as the system itself. This is based on the fact that the process of accumulating capital must ever expand and in the processes leading to class formation and further polarization. Investment in agriculture is expected to yield growth where more wealth can be realized, but the main question remains with the underlying social relations in the process of production in terms of who determines the production, reproduction and distribution of a social product. It is through these underlying relations where growth has often led to more differentiation (Robins, 2011).

Differentiation in this case is viewed not as a product of growth or high productivity but rather exploitation within the production system as the need to expand production for profit maximization arises. Expansion of profit within capitalism is described by Bernstein as done through "productive capital" which is invested in the means of production (land, tools, raw materials etc.) and labour power. Here labour power is seen as a commodity used to create "a relatively greater value than its own value" and in this case bought by the capitalist to create a greater value (Bernstein, 2010). In this process, those who possess the productive capital are involved in the process of profit accumulation and usually do that on the expense of those who provide labour. The analysis of accumulation processes in this study will, therefore, focus on how differentiation is likely to prevail and intensify in the process of agriculture transformation and irrigation investment in Kilombero. The purpose is to understand different forms of productive capital and their forms of ownerships and examine different ways in which labour power is commoditized in irrigation agriculture and how the social conditions of capitalist productions are established. However, analysis of the socio-economic differentiation will be more focused on accumulation from below and how these processes manifest themselves in the development of agricultural production in Kilombero and what the resulting features are, specifically as far as social differentiation is concerned. Accumulation from below can best be understood in distinction from the processes of accumulation from above.

Accumulation from above and Accumulation from below

The distinction of these two types of accumulation processes can be traced back to the works of Lenin in 1896-1899. Lenin was concerned with the agrarian question of the working masses (proletariats and poor peasants) however Bernstein further links this view to the agrarian question through two forms in which agrarian change occurs, namely the Prussian form and the American form (Cousins, 2013; Bernstein, 2010). Bernstein points out that central to the Prussian form, "the pre-capitalist feudal landed property transforms itself into capitalist" while in the American path the capitalist farmers emerged from the

smallholders who were once independent but later due to the social conditions of capitalism became integrated in the commodity relations of capitalism (Bernstein, 2010).

The two forms, Prussian path and the American path represents processes that are described as 'accumulation from above' and 'accumulation from below' respectively. Mamdani when analyzing this double character of accumulation, describes accumulation from above as a process in which market forces are influenced by extra-economic coercion. These are usually organized by a relatively higher level of power such as "the state, state-connected organizations such as party or church and individual state agents". He further describes accumulation from below which is a spontaneous process where the internal inequalities determine the differentiation process specifically through internal competition resulting from the emerging commodity relations (Mamdani, 1987).

The distinction of these form of accumulation is usually related to the political (democratic) significance and class character of the two forms. While in accumulation from above there is limited democracy due to the coercion, usually by the state or other extra-economic coercions, the accumulation from below usually involves 'voluntary growth' of the smallholders and can based on this be seen as more desirable as it represents minimal rupture with the prevailing productions relations. and in this case there is hidden exploitation within classes and the main difference being that they do not share the same economic position. This is despite the fact that the presence of the role of the state and market forces prevails in both situations (Mamdani, 1987, p. 203).

Current studies in pro-poor growth however have stressed the increased inequalities and further differentiation within the smallholders. Djurfeldt and Hillbom points out that there has been a relative relevant increase in differentiation among smallholders in Kilombero with and without necessary increased in growth of incomes (Andersson Djurfeldt & Hillbom, 2016). However as far as accumulation processes are concerned there is a need to further understand the dynamics of the differentiation process and the ability of smallholder households to accumulate productive capital by dispossessing other smallholders (Bernstein, 2010). Furthermore, as far as investment in irrigation is concerned there is a need to see how these investments are able to influence accumulation processes either internally (among irrigation farmers) or otherwise.

These theoretical concepts will guide me in understanding how the practices and dynamics in irrigation agriculture in Kilombero shapes agriculture growth and accumulation from below and how this growth is likely to be inclusive (or not) in the context of increased differentiation associated with the processes of accumulation from below. At the same time the theory will help in highlighting the processes of accumulation from below specifically through dispossession of productive capital among smallholders and its impact on dif-

ferentiation. My focus on accumulation from below also present a complementary perspective to the theorisation focussing on accumulation by dispossession and accumulation from above approaches that aim to understand how the large scale investments are dispossessing the smallholders. While processes of accumulation from above does prevail, studies in Tanzania show that some of these large scale investment are either in a halt or have failed to materialise to the extent that they were envisioned. At the same time, other forms of accumulation are ongoing and are likely to have a substantial impact on differentiation processes in the current context of agricultural growth, modernization, smallholder inclusion and increased agricultural investments in Kilombero.

4. Methodology

This section describes some of the strategies that I have used in my study as well as the logic behind such strategies. I will therefore start by substantiating the study design, then description of the study area followed by explanation behind my choice of methods, and how I analysed resulting data. The last part will be on reflexivity where my positionality will be unpacked and present how I intend to share these study findings with field participants.

Study design

I rely on a case study design in this study which is very useful in (but not limited to) the exploratory stages of a research project. It allows a more intense observation of a few cases, but further allows one to further develop more structured tools (Gerring, 2006; Rowley, 2002). Moreover, the design is also useful when one is interested in first hand intersection between the context in which the study is done and the phenomena under study (Yin, 2009, 2014) (Yin R. K., 2009; Yin R. K., 2014). In this case, Yin (2014) further describes the phenomena as temporary, however, de Bont (2018) citing (Hancock and Algozzine, 2011) mentions that this temporal usefulness of the strategy extends to a historical description of the dynamics underlying such phenomena (de Bont, 2018).

I used Kilombero district as my case study where I did two periods of fieldwork, one month in June to July 2017, and another two months from June to September 2018, which makes three months in total. The case study involved a number of villages purposely selected within the district which were used to understand dynamics both in agriculture and irrigation investments through three main sub-studies that were used to develop different papers for this study. Purposeful selection of the Kilombero as case study was influenced by existence of a previous study in the area which I was keen to build on. I had in mind that a case study design has that ability to guide in making use of the existing theoretical propositions in both data collection and analysis (Yin R. K., 2014, p. 17). Here, the previous study by (Kangalawe & Liwenga, 2005) which uses wealth ranking to understand the livelihood dynamics associated with agricultural use of wetland resources was useful. This previous study further influenced development of my methodology, in terms of choice of villages, but also, some of the methods which I built on specifically during my first field visit. Analysis of social differentiation processes in Kilombero also

drew from a previous study by Sulle (2017) who was focused on social differentiation among sugar cane outgrowers' schemes, also in Kilombero.

The case study was therefore used to develop all the papers but with a difference in the focus for each paper. The first and second paper were part of the first sub-study that aimed at opening up understanding and intensely follow up the history of agricultural and irrigation transformations in Kilombero. A central area of focus being the resulting differentiation in ongoing public supported smallholders' small-scale irrigation investments in the area. With a Marxian political economy approach guiding this study, transformations here entails understanding the processes during agriculture and irrigation development in which 'capitalism seizes agricultural production and differentiates agrarian classes' (Levien, Watts, & Hairong, 2018). This further entailed among other things, how investments that are made in lined irrigation relate to different socio-economic groups, the state, and the market forces.

In this thesis I have used qualitative methods followed by a questionnaire survey. I employed a strategy that Creswell refers to as 'exploratory sequential mixed method' which involves first using a qualitative research methodology for exploratory purposes in the initial phase then using the qualitative data to inform the following quantitative study (Creswell, 2014). I selected this strategy given the fact that I needed to first explore the current dynamics within the area and also given my interest, training and experience in qualitative methods. Following the pattern of differentiation observed during the first phase (reported in paper 1 and 2), I designed a survey to also collect quantitative data (paper 3) so as to add to the previously analysed qualitative material.

The qualitative information gathered during the initial explorative phase involved views of the participants on social differentiation through their perceptions of wealth and how this relate to both agricultural dynamics and smallholder irrigation investments. These views therefore helped to capture a variety of the respondents' experiences and perceptions in the study area over time. Given the fact that a qualitative case study design allows use of a number of methods altogether, we used data from participatory wealth ranking, interviews and walking interviews as well as mapping of the canals for this purpose. This is due to the fact that a case study allows for both in-depth study aiming for rich and detailed descriptions of a specific issue and the combination of multiple methods in data collection for triangulation and validation purposes (Gomm, Hammersley, & Foster, 2000; Yin, 2009).

In the first paper on land use and land cover change in Kilombero, the study takes a broader context than the second paper in the sense that the first paper expands in both scale and time to trace the historical development of irrigation and land use changes within these smallholders' irrigation development over time. This paper was developed simultaneously with the second paper but was more focused on irrigating villages and transformations within the irrigated areas. In this case, Njage, Msolwa Ujamaa, and Mkula villages were purposely selected.

In the second paper, I used collaborative ways of exploring qualitative changes using participatory wealth ranking (Howitt & Stevens, 2016) to illustrate the socio-economic (class) differences among smallholders in Sululu and Signali (formerly Signali), Njage, and Idete villages. Out of these villages, a choice of Sululu and Signali, as well as Idete villages was influenced by my intention of following up a previous study by Kangalawe and Liwenga (2015). However, given the challenge encountered in accessing the complete data set from the previous wealth ranking and that it was not possible to identify and locate the same persons who participated in the previous study, I did a new wealth ranking, following the same methodologies used in the previous study. Wealth ranking was also used as an entry point for further interviews so as to come with a detailed understanding of how irrigation investment was used as a mechanism for accumulation by different socio-economic groups. In this case, interviews were held with people from different socio-economic groups in order to capture the experiences of the differentiated smallholders. Therefore, instead of focusing on experiences and motives of irrigation planner's 'biased' history and common narrative that irrigation is likely to lift the poor out of poverty, while bypassing the experiences of the poor, my focus was to highlight different experiences and trajectories of different socio-economic groups, including the poor.

Moreover, Njage village was also purposely selected in the second paper given its geographical location in the inner, more southern, part of the valley, but also, the presence of a relatively older lined irrigation canal system within the village. Hence, for the study reported in paper 2, I had two villages, Sululu and Njage that were irrigating but on different geographical parts of the valley, at the same time two non-irrigating villages, Signali and Idete also differentiated by their geographical locations in the valley. While Sululu and Signali located in the north-eastern part of the valley, before you reach Ifakara, Idete and Njage are located on the other side of Ifakara in the south-western part of the valley.

My second sub-study, reported in paper 3, included the irrigating villages of Msolwa Ujamaa, Mkula, Sululu and Njage and is focused on farmer-state-market interaction in smallholder irrigation. It analyses the development of irrigation in areas where investment in lined smallholder irrigation canals had already been done. The aim here was a to trace the development of irrigation and contextualise the real-world experiences of smallholders associated with such investments but also to capture changes within the irrigated areas and how these changes could be used to understand underlying irrigation policies. In this case, the development of irrigation also accounted for the farmer-led perspectives and understanding of the drivers towards such developments and how lining of the canals were perceived. With a focus of analysing how inclusive (and pro-poor) public investments in irrigation could be, choice of case study was further influenced by the need for case studies analysing initiatives aimed at stimulating pro-poor growth (Djurfeldt & Hillbom, 2016).

This was later followed by a questionnaire survey in which I focused on state-smallholder-market relations in the irrigated agriculture. I used the qualitative data from the first sub-study to further develop questions that were used for the quantitative survey but also to proof check and triangulate the quantitative data. Questionnaires were developed and distributed so as to understand the dynamics in lined and unlined canal as well as non-irrigated and rainfed cultivation practices. Most of the questions and their closed options for selection were directly informed by my previous observation on types of irrigation prevailing in the area, crops cultivated, tools used in cultivation, and land renting practises to mention a few.

Taking into account that people could be excluded from these irrigation investments for a number of reasons, the focus on the smallholder-state-market interaction also aimed to analyse how the transformation from unlined to lined canals is likely to impact on the smallholders' individual experiences as some are excluded when demand for productivity arises. A study by Tobin et al. (2016) on inclusion and exclusion in potato value chains and a study by Baeten et al. (2016) highlights that non-participants in interventions may not always view their exclusion as a bad thing, but may rather also choose to stay out of such interventions so as to avoid the associated risks (Tobin, Glenna, & Devaux, 2016; Baeten, Westin, Pull, & Molina, 2017). These two studies both highlight the need to capture these experiences, rather than assuming these interventions are ubiquitously good for the poor.

Table 1. Summary of the sub-studies

	Paper	**Area covered**
Sub-study 1	Paper 1 and Paper 2	Signali, Sululu, Idete, Njage, Msolwa Ujamaa and Mkula.
Sub-study 2	Paper 3	Villages with lined canals: Msolwa Ujamaa, Mkula, Sululu, and Njage
Sub-study 3	Paper 4	District offices and KATRIN in Ifakara town, Msolwa Ujamaa, Mkula, Signali, Sululu, Idete, Njage

The third sub-study informed the development of the fourth paper (paper 4) which was focused on the question of rice as a boom crop in Kilombero. In addition to the other sub-studies, which involved interviews with farmers in both irrigating and non-irrigating villages, interviews for this final sub-study

were also conducted with district officials and researchers from Kilombero Agriculture Training Institute – KATRIN and the Rufiji Basin Water Office in Ifakara. The case was focused on wider transformation associated with rice in the area and most importantly the quest for increased rice productivity in Kilombero and how this was reflected in a local discourse of progressiveness.

The Study Area

The Kilombero valley is located alongside the Kilombero River flowing in between the Udzungwa Mountains, Mahenge escarpment and the Selous game reserve, within Kilombero and Ulanga Districts of Morogoro Region, Tanzania. The valley is located about 300 km from the coast and covers an area of about 11,600 km^2 with an inclusion of the marginal hills, whereby its total length is 250km and width of up to 65 km (Jatzold & Baum, 1968; Kato, 2007; Nindi et al., 2014). Topographically, the marginal hills and strips of about 6 km wide on either sides consists of the outer valley which on the basis of large alluvial plains in the valley may be described as "alluvial uplands" which rises to as high elevation as 700m and 1,700m extending towards an east-west direction. The inner valley on the other hand consists of a floodplain with the largest seasonal wetland and the largest freshwater wetland in east Africa at an altitude of less than 300 meters above the sea level (Jatzold & Baum, 1968; Kato, 2007).

The rainfall pattern is unimodal and with annual rainfall ranging from 1200 to 1,400mm per annum (Wilson, Mc Innes, Mbanga, & Ouedraogo, 2017; Kangalawe & Liwenga, 2005). The rainy season is usually between Mid-November to mid-May every year with potential slight dry periods in between December and March. The valley usually reaches its flooding peak during March to April although it may happen that flooding could occur as early as January and as late as May in some years (Kangalawe & Liwenga, 2005; Nindi et al., 2014).

It is almost impossible to travel across the valley in the flooding seasons, the only reliable means of transport in that period is through the TAZARA railway. However, in the dry season the valley can be accessed also by the Mikumi-Kidatu-Ifakara road that reaches to the inner areas of the valley, such as Njage, Mofu, Mbingu, Mngeta and up to Mlimba. There is also a newly constructed bridge, which since 20xx replaces the ferry at Kivukoni in Ifakara and joins the road to Mahenge and other parts of Ulanga district. Travelling through the valley offers a fantastic view of the landscape where conservation and other anthropogenic activities, mainly farming, tree plantations and settlements can be seen. Historically, the valley has been part of the Majimaji war between the local populations and the German colonialists in which the local population were against the establishment of cotton plantations in the area.

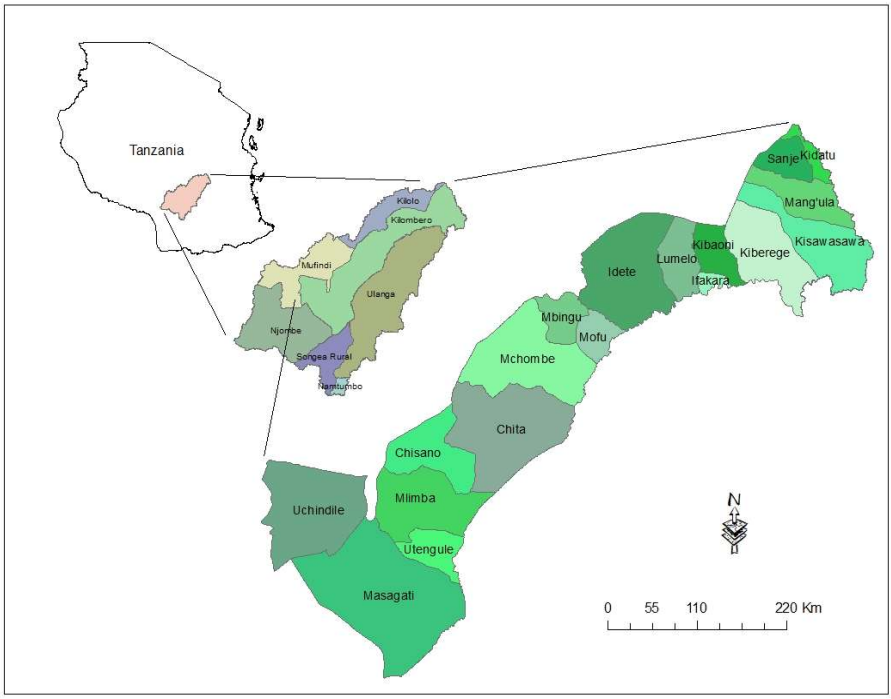

Figure 2. Map of Kilombero showing Morogoro region, Kilombero valley and wards within the Kilombero district 2012.

The area is recognized by the International Union for Conservation of Nature (IUCN) as an area of global importance and also declared a Ramsar site since 2002 (Jatzold & Baum, 1968; Kangalawe & Liwenga, 2005; Nindi et al., 2014). The valley lies within the Greater Selous Ecosystem and is endowed with a number of protected and unprotected areas such as Teak forests, the Kilombero Ramsar site, the Selous game reserve, and the Kilombero Game Controlled Area (KGCA) which acts as an important wildlife corridor between Udzungwa Mountains and Mikumi National Parks (Nindi et al., 2014).

Numerous rivers flows into the Kilombero valley floodplain. These include Mnyera and Pitu from the south flowing together with Ruhuji and other smaller streams like the river Lumemo, river Njage to mention a few, forming a myriad of tributaries in the middle of the floodplain supplying the floodplain with plenty of water (Dinesen, 2016). There is however a great variation in the level of water during the flooding season to the dry season where some of these tributaries dry up. Presence of these tributaries in the floodplain favour numerous economic activities in the valley including agriculture and fishing. The valley is considered to be one of the areas with best potential for agriculture, both irrigated and non-irrigated, in the country and is one of Tanzania's largest inland fisheries area (Beck, 1964; Kangalawe & Liwenga, 2005).

This study was done in the Kilombero district within the Kilombero river valley[2] floodplain bordering the Udzungwa Mountains in the north-west, Kilolo district in the south, Kilosa and Morogoro rural districts in the north-east. The district borders Songea rural district and Ulanga District in the south and Mufindi in the south-west and Njombe districts in the west. It is located in between latitude 70° 40 ' and 90°21' south of equator and in between longitude 35°20 ' and 37°48' east of the Greenwich line. The district covers an area of 11,025 km^2 with a total of 26 wards (from a total 19 wards during the 2012 census) and 99 villages[3]. According to the Tanzanian National census of 2012 the district's population was a total of 407,880 people but introduction of Ifakara Town Council as a separate administrative area within the district reduced total population of the remaining Kilombero District to 301,456 with a projection of a total of 339,092 people in 2017 (NBS, 2016).

Out of the total 595,245.65 ha of village land, agriculture production covers about 407,747 ha out of which a total of 47,619.30 ha are identified as areas with irrigation potential. There are 16 areas which have been identified as suitable for improvement of the unlined irrigation in the district, some of these already have running partly lined irrigation schemes and some of the schemes have been identified to be lined and proposed for agriculture. Some of the running schemes include Msolwa Ujamaa, Mkula, Sululu (Signali), Mang'ula Youth Group and Njage. Most of these schemes however are not running in their full capacity. Other identified areas for irrigation investments are Kisawasawa, Maki, Sanje, Kiberege, Kisegese, Mkangawalo, Ikule, Udagaji, Mgugwe, Mpanga/Ngalimila and Sonjo. It is pointed out that, these planned irrigation schemes are to be established within the next two decades and are expected to stimulate a steady increase of irrigated land in Kilombero and lower Rufiji valleys by almost 200,000 hectares in total (Mcclain et al., 2016).

Agricultural History: Kilombero District

The area has a very large potential for agriculture and irrigation, even if the wetlands and regular flooding also has been an obstacle for agricultural development, which is also reflected in its pre-colonial and colonial history. Telford in his 1928 survey of Rufiji and Kilombero valley points out that the region had "well cultivated [and] carefully tended farms" (Telford, 1929; Hoag & Ohman, 2008, p. 624).

In the colonial period, thepotential for cotton and sugar production attracted interests in railway construction in the area (Jack, 1932). The introduction of large scale cash crop production in the area, specifically cotton, was identified

[2] The most part of the Kilombero district is the Kilombero river valley however there is a small part of the district which is in Rufiji river basin and Selous Game Reserve.

[3] See more The Kilombero district website (http://www.kilomberodc.go.tz/)

to be incompatible with food crop production. This incompatibility is associated with the Majimaji war of 1905 as cultivation of such cash crop was affecting the livelihood of the farmers in the area (Hamerlynck, Duvail, Hoag, Yanda, & Paul, 2010). The conflict could be one of the reasons for scepticism in investing in similar large scale agricultural and irrigation developments in the valley during this era. However, there remained a need for the colonial government to extract surplus from the smallholders, who were allowed to retain ownership of land but were subjected to extra-economic coercion specifically through different types of taxes so as to take control of the labour process (Shivji, 2017, p. 4). In response to this, it is noted that farmers tended to farm a 'miniscule plot of 0.1 ha' of cash crops so as to obtain cash to pay for their hut tax beside their other (subsistence) activities (Telford, 1929; Hamerlynck, Duvail, Hoag, Yanda, & Paul, 2010, p. 227).

In the post-colonial context, the irrigation potentiality of Kilombero valley was further pointed at in the F.A.O report of 1961 which argued for large scale irrigation development and to expand cultivation and flood control in the area (Beck, 1964, p. 39). Underlying the FAO report is a narrative of available unused and empty land. This narrative was further problematized through the question of uneven distribution of population specifically among smallholders, leading to an argument for the necessity of resettlement. Resettlement was later among the main agenda of the government during the period of Ujamaa policy in the country. The Ujamaa policy was launched in the country in 1967, and focused on the principles that "people should live together, own the means of production together and work together and therefore should share the fruit of their labour equally" (Hydén, 1975). Hydén further stresses that the programme was influenced by foreign donors, who advised the Tanzanian government during this period to start village settlements with one of the aims being to engage "in agricultural production on a capital intensive basis" (ibid, p. 55). What was proposed in Kilombero was therefore a clear reflection of the bigger picture behind the overall policy.

With the new post-colonial government focusing on putting its own stamp on the country's development, the focus was on harnessing resources so as to fuel their development agenda. Therefore, during this period but prior to the introduction of Ujamaa policy in the country, initial investments in irrigation agriculture for agriculture expansion in Kilombero were revived (Hamerlynck, Duvail, Hoag, Yanda, & Paul, 2010). Major large scale investment in the Kilombero valley were done in 1962 where Kilombero Sugar Company Limited (KSCL) with a total concession of about 25,000 acres was opened in the area, with sugarcane outgrower schemes for the purpose of incorporating smallholders (The Empire Forestry Association, 1960, p. 272; Beck, 1964). The company was established as a joint venture financed by the International Finance Corporation, the Commonwealth Development Corporation, Standard Bank and two Dutch development finance agencies (Sulle, 2016). This

was later on followed by other large scale agricultural investments in Kilombero.

The Mngeta Farm was established in 1986 in a joint venture between the Tanzanian) and North Korean governments (KOTACO). While these plans were able to materialize, there were a number of large scale agriculture and irrigation development plans that never materialized. These include a surveyed 10,000 ha farm by Sugar Development Corporation (SUDECO) with a help of the British Booker Tate Company in the area around Ruipa valley with a purpose of establishing a sugar cane plantation, within the area that was previously demarcated for proposed irrigation Development by FAO in 1961 (Blache, 2018; Jatzold & Baum, 1968).

These large scale investments as well as its plans existed hand in hand with the villagisation policy and creation of Ujamaa villages in the area. Blache describes the villages and construction of Tanzania-Zambia Railway (TAZARA) as among the most important processes specifically among the smallholders in the valley. This is as villages were created and other grew up along the railway and many of these Ujamaa villages were created in previously farmers and TAZARA labourers' settlements. In Signali, for example, an Ujamaa village was created in 1974 in a former migrant railway workers' settlement (Smalley, Sulle, & Malale, 2014). To Blache, the two processes (Ujamaa villages and TAZARA construction) influences the geography of the population in the valley as they attracted people and facilitated (and are still facilitating) movement and settlement of people within the valley (Blache, 2018).

While prevalence of smallholder traditional irrigation is mentioned to have prevailed in the area prior to the period of Ujamaa (Jatzold & Baum, 1968), investments in lined irrigation canals can be traced from this period. A good example being the construction of an irrigation canal in 1975 for a Chinese agricultural training centre in the village Msolwa Ujamaa. The Chinese later left in 1980 and the canal that was left behind was used for smallholder production of both rice, maize and other horticultural products in both wet and dry seasons. In nearby Mkula, after farmers had developed their own traditional irrigation in 1978, the government came in and constructed an intake and lined several meters of the main canal in 1979.

From this large scale and smallholder co-existence, one could note that despite its shift towards Ujamaa and villagization, during the period after theArusha declaration in 1967, the agricultural strategy in Tanzania was not very much distinct to that prior the declaration. Prior to Ujamaa, the agricultural strategy in Tanzania was based on both "improvement" and "transformation" approaches, where the first was focused on small scale agriculture and cooperatives and the latter on large scale agriculture and irrigation (Coulson, 2014; Hyden, 1980). While actors and the underlying philosophy changed during Ujamaa, as there was nationalization of large scale means of

production, the same basic development strategy prevailed. Hence, efforts towards smallholder improvement and transformations through large scale investments and planned investments persisted. Large scale agricultural and irrigation investments that materialized and those which did not materialize were put under state control in this period. KSCL for example, was nationalized following the implementation of the Arusha Declaration in 1967.

Privatization followed in the 1990s following the structural adjustments programmes (SAPs) aimed to restructure poor performing institutions and reduce state involvement in production. In this period KSCL was privatized in 1998 to Illovo (50%), ED&F Man (25%).The Tanzanian government remained with the remaining 25%. Later on Mngeta farm was also privatized in 1999 to Kilombero Holding Company which was unable to run it and is currently run by Kilombero Plantations Limited (KPL) since 2007 (Mung'ong'o & Kayonko, 2009). In the case of large scale agricultural and irrigation plans that did not materialize, there have also been plans to revive them. Among these efforts has been the reviving of the sugar cane plantation in the Ruipa valley and irrigation in Idete prison which has a parcel of land in a land that was previously demarcated and proposed for large scale irrigation by FAO in 1961. In the Ruipa case, there have been attempts by the government and the Sugar Board of Tanzania in 2005 to reallocate the "ownership" of the land to the Illovo Group through district officials. However, this also has not materialized as Illovo pulled out of the deal due to disputes with communities that have already settled in the area since the 1970s as they demanded compensation (Blache, 2018; Sulle, 2016).

Choice of the Study Area

Choice of Kilombero district as a case study area is influenced by the fact that the area for years has been marked as a high potential area for agricultural development (Beck, 1964, p. 39; Jack, 1932). This is associated with its abundant water resources and fertile alluvial soil. In the colonial period, as described above, the potential in cotton and sugar production attracted interests in railway construction in the area (Jack, 1932). Since 1909 when the Germans were surveying for a railway route through the valley (Beck, 1964) there has been several reports identifying the area as promising for agriculture development in Tanzania (Jatzold & Baum, 1968). These reports, including the East African Royal Commission 1953-1955[4], Telford (1928)[5], a soil survey by

[4] See East Africa Royal Commission 1953-1955, *Report.* London. HMSO. 1955

[5] See Telford, A. M. (1928) *Report on the Development of Rufiji and Kilombero valleys.* Dar es salaam.

FAO (1961)[6], and a land use survey by Loxton (1951)[7] all together identified the valley as "an agricultural zone of high potential" (Beck, 1964, p. 37)

Moreover, irrigation is also one of the potentials that could be historically traced in the area. This is specifically so for the post-colonial period following the 1961 FAO report which argued for large scale irrigation development and an expansion of cultivation and flood control in the area (Beck, 1964, p. 39). While some of these large scale irrigation developments have yet to materialize, relatively smaller smallholder irrigation developments emerged in the 1970s as farmer-led initiatives, which were later developed and lined with concrete as they received support from the district.

The introduction of the 'Kilimo Kwanza' resolution as a guiding policy initiative in Tanzania in 2010, and followed by SAGCOT in 2011, has again marked Kilombero river valley as a target area for agricultural investment and modernisation, not least through outgrowers' schemes. Despite the fact that SAGCOT investments in the area through outgrowers' schemes have not yet materialised, the potentiality of the area in agriculture and irrigation overtime has attracted large numbers of people and investors to the area. These include large scale commercial investors, government institutions, pastoralists as well as medium and small scale investors in agriculture and non-agricultural activities.

What is particularly interesting for my study is that amidst these large scale SAGCOT plans there are also plans for smallholder irrigation building on prevailing smallholder activities as summarised in table 2. In the process, there has been investment in irrigation schemes in the area where the local government authority through the Kilombero District council as well as other development partners such as the Japanese development organisation (JICA), The American development organisation (USAID) to mention a few, have been involved in the improvement of irrigation and agriculture investments in the district. Unpublished Kilombero district sources provided during interviews indicate that among these investment, are a number of running irrigation schemes where 5 are already lined and working and others (11 schemes) awaiting further investments. The aim mostly being improvement of agricultural production and to ensure inclusive and pro-poor growth.

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[6] See F.A.O (1961) *The Rufiji Basin: F.A.O report to the Government of Tanganyika on the Preliminary Reconnaissance Survey of the Rufiji Basin.* F.A.O. Rome

[7] See Loxton, R. F. (1951) *Kilombero Valley Land Use Survey:* Block A. Dar es Salaam.

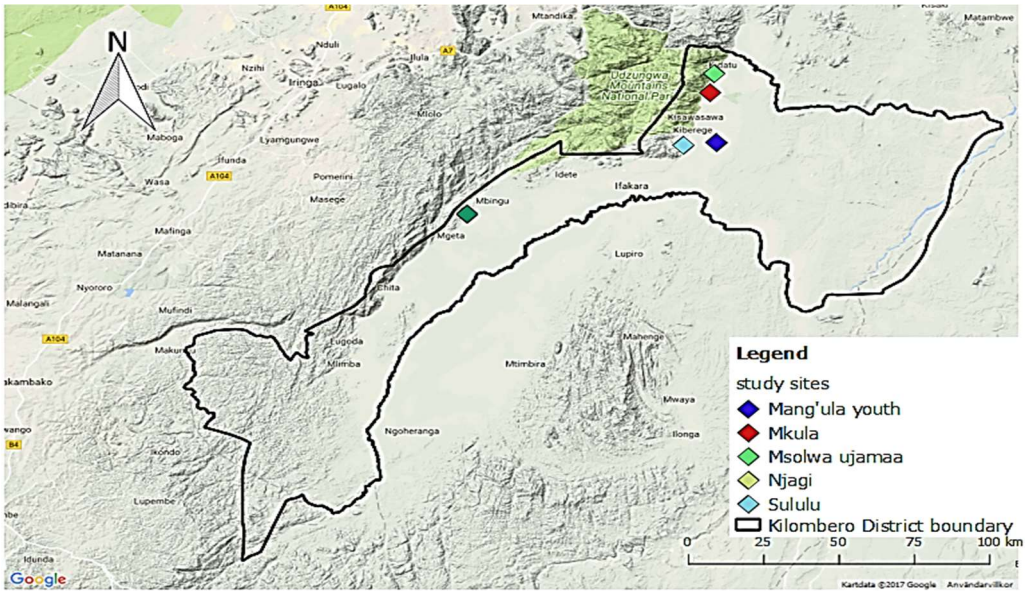

Figure 3. Map showing running lined irrigation schemes in Kilombero district, 2017

Table 2. The Major Characteristics of the Study Villages, Kilombero District

Village	Access to roads and services	Proximity to urban centre (Ifakara or Kilombero)	Main crops produced	Agricultural systems and liveli-hood
Msolwa Ujamaa	Very Good	Very close to Kilombero	Rice and sugarcane	Irrigated, Rainfed and business
Mkula	Very good	Very close to Kilombero	Rice and sugarcane	Irrigated and rainfed
Sululu	Fairly good	Fairly close to Ifakara	Rice, maize and horti-culture	Irrigated and rainfed
Signali	Fairly good	Fairly close to Ifakara	Rice and maize	Rainfed and business
Idete	Good	Fairly close to Ifakara	Rice, maize, teaks	Rainfed and business
Njage	Seasonally good	Not close	Rice, Maize, Cocoa, Ba-nanas	Irrigated and rainfed

Source: Field data

Given my interest in agricultural and irrigation development, the quest for inclusion amidst a reality of social differentiation the area serves as a relevant case study area for my thesis. Thus the study area as a point of focus of current policies and practices focused on agriculture growth through commercialisation and modernisation will be used to understand the dynamics of inclusion and differentiation related to investments in smallholder irrigation. In smallholder irrigation investment, the underlying accumulation processes associated with social inclusion and exclusion are also of interest. Another area of interest is how historical prevalent and socially differentiated smallholders in Kilombero experience these investments and dynamics with a potential increasing competition for resources by different users, including also other actors than smallholders (i.e. large and medium scale farm operations).

Methods

Participatory Wealth ranking

I used participatory wealth ranking in this study as a participatory assessment of wealth of the households within the study area. It is described by Liwenga (2003: 39) as an "approach that can be used to provide information about the socio-economic characteristics of local people". The approach is further viewed as a tool or method used to identify local indicators and criteria of wealth, inequalities and poverty (Reddy, 1999). It employs the local perceptions of the individuals in a particular social context to identify criteria that are used to understand wealth differences, and their perceptions towards these differences. These criteria and perceptions play a crucial role in understanding wealth differences from a bottom-up approach.

My use of the participatory wealth ranking was influenced on one hand by the fact that I was unable to find wealth registers within the villages that the study was done, which could have been relevant in distinguishing different socio-economic groups. On the other hand, as Campenhout (2006) suggests, that the use of wealth ranking provides a good qualitative alternative to other conventional approaches such as household consumption, proxy means test and poverty line measures. These conventional measures tend to simplify what it means to be poor or wealthy, are often biased and lack transparency as they focus more on objective analysis of income and expenditures (Ravalion, 1998; Bebbington, 1999; Karlan & Thuysbaert, 2016, p. 2). It is further argued that they are unable to capture informal sources of income usually in kind (Deaton, 1997; Karlan & Thuysbaert, 2016), and exclude some of the durable items and investments that are done by the households by merely focusing on consumption expenditure (URT, 2007). These durable items are rarely purchased and therefore omitted as outliers in the sense that they are not typically included as household consumption. In this case, Brockington et al. (2018) add that focusing on household consumption expenditure cannot capture investments in assets (such as cars, motorbikes, power-tillers, tractors, plough and houses)

which are crucial in understanding rural development (Brockington, Howland, Loiske, Mnzava, & Noe, 2018).

In socio-economic groupings that are used in the Tanzanian Demographic and Health Surveys (TDHS) for example, wealth index was constructed using expenditure and income measures including some household assets. This is seen as a way in which to adequately capture inequalities by relating socio-economic status with observable assets and other underlying expenditure and services accesses by the household (United Republic of Tanzania, 2016; Tanzania & Macro, 2011). Scores are given for different assets that a household owns with an aim of quantifying these assets objectively. However this has been widely criticized as being urban biased as it entails some of the assets, services that are common to the urban rather than rural populations based on the general assumption that are likely to be more frequently owned as wealth increases (Rutstein, 2008). At the same time the perceptions of rural populations on the importance of these assets is not accounted for and also the rural structural context that may limit possession of such assets and access to those resources are largely ignored. Further, absence of services such as clean water and electricity may influence the way one will choose to buy assets or construct a toilet.

These critiques of the wealth index highlights what could be referred to as its 'deep colonizing' methodological approach which uses an urban or rather modern "hall of mirrors" as a reflection of growth and prosperity (Howitt & Stevens, 2016). This reflects the dominant critique of the objective positivistic methods that usually aim at generalizing and universalizing knowledge to arrive at a particular universal truth. In this case, despite the fact that wealth ranking is seen as not very useful in assessing poverty and wealth at wider geographical scales, it is rather useful in assessing relative wealth and poverty at the local community level (Zeller, Sharma, Henry, & Lapenu, 2005).

At the same time, critiques of participatory research have over time posed a number of concerns and it has been argued that the process and practice of participation may also be a 'tyranny (Cooke & Kothari, 2001). This tyranny is associated with the underlying discrepancies between the theory and process/practice of participation. Three main problems of participation, associated with decision making and control, group dynamics and group interests, as well as methods, are pointed out. Central to this critique is the unjust exercise of power in the participation process that is likely to affect the process and outcome of participation, domination of some dominant groups (including the researcher) and how it is likely to affect other methods that may have advantage over it (Cooke & Kothari, 2001).Given this critique, the argument has been that some research practices that claim to be participatory may be less participatory than others. Francis (2001) have for example analysed and critiqued how IMF and the World Bank have both been using participatory research in developing countries (Cahill, 2007; Francis, 2001).

Cahill however acknowledges the importance of participatory research, despite the fact that her focus was more about development of new subjectivities in Participatory Action Research (PAR). She sees participation as offering a 'viable, vital alternative to the exclusionary domains of academic research' (Cahill, 2007, p. 269). Such a vital alternative for the purpose of my study can be discussed in relation to the recent studies using participatory wealth ranking in a Tanzania context. One of this is the study by Brockington et al. (2018) which offers an alternative view to the dominant consumption and expenditure measures of poverty which view the current perspective on economic growth as neglecting the rural poor. To Brockington et al. (2018) these measures, as previously discussed in this part, are based primarily on measures of consumption and therefore overlooks change in assets. Therefore by doing a follow up study of previous participatory wealth ranking that was done in the area 20 years ago, the study suggests that ignoring assets in the studies of inclusive growth is therefore premature as it is unable to capture the asset dynamics (Brockington et al., 2018).

Wealth ranking in this study was therefore done for 2 main reasons. First, this study aimed at revisiting villages and partly build on similar methods that were used in an earlier study of social differentiation and land-use by Kangalawe and Liwenga (2005). I intended to use this previous wealth ranking to capture the dynamics in wealth patterns since the previous wealth ranking done in 2004. Unfortunately, it was not possible to identify and follow up the same households ranked in 2004, therefore I could only base the comparison with the 2004 ranking on using a similar methodology in how the rankings were previously performed. As one of my supervisors, Liwenga, designed and participated in the wealth ranking in 2004 I had good insight into how to perform the wealth ranking to make it comparable with the methodology used in 2004. Liwenga's experience from 2004 has also been critical for my ability to make sound interpretations of the change in wealth distribution based on the rankings. Secondly, the wealth ranking was used in this study to stratify the selection of informants interviewed and categorise them in specific socio-economic groups in the second step of data collection which involved interviews. Hence, people's perceptions of wealth and ownership of assets (including capital agricultural assets), as part and parcel of agricultural dynamics, were taken into account as they are considered to be significant in the local definitions of poverty and wealth (Brockington et al., 2018; Howland et al., 2019).

The wealth ranking I did started with the key informants from the village leadership and local communities were selected to participate in a group discussion. These leaders were mainly sub-village ('kitongoji in Swahili) leaders, while the local communities' representatives included 2 representatives of different sex and age from each sub-village. Community representatives were purposely selected on the basis of extensive knowledge of the people and environment of the sub-village and the village at large. The key informants were

required to have been living within the village for at least 10 years or more. Together with the informants I did three main things. Firstly, we (me and the informants) discussed about common criteria of wealth according to their perception that could be used to differentiate wealth among households. Secondly, we discussed how these criteria of wealth inform their construction of existing socio-economic categories/groups and by what underlying means and strategies of each group. Thirdly, based on a list of names of all villagers that we obtained from both the village and sub-village leaders, as well as those added to the list by the participants in the wealth ranking, we categorized different households through identifying the head of household and associated them with each of the socio-economic group that were previously identified. Apart from this, the discussions and wealth group categorization also went hand in hand with the definition and explanations of different wealth concepts and the history of each wealth group in terms of how it emerged, how long it had existed and any dynamics that were associated with composition of each socio-economic group.

I did this participatory wealth ranking in Idete, Signali and Njage villages, where information obtained formed a basis for my selection of further interview participants. At the same time, wealth ranking was able to highlight both the agricultural and livelihood dynamics over time. Social differentiation processes were highlighted and discussed by participants. The information obtained from wealth ranking was centred on an analysis of relative poverty within the study villages, which, as discussed above, is different from the type of wealth index that is used to highlight urban-rural wealth disparities and wealth differences in a wider, e.g. national, geographical context.

Interviews

There was a need to capture the experiences of the smallholders given the fact that as a distinct sub-cultural group located in a particular landscape, smallholders have their own distinct realities and experiences (Kuehne, 2016). I therefore used interviews with different smallholders from different socioeconomic groups to capture their experiences. This also follows the logic similar to that used by Beaten et al. (2016) in their analyses of housing gentrification with a focus on the experiences of displaced people (Baeten et al., 2016). I follow the similar logic in the interviews to highlight history and both the processes of social differentiation as well as inclusion and exclusion in irrigation investments. Therefore, instead of focusing on experiences and motives of irrigation planner's 'biased' history and common narrative that irrigation is likely to lift the poor out of poverty, while bypassing the experiences of the poor, my focus during interviews has been mainly to highlight different experiences and trajectories of different socio-economic groups, including the poor.

The wealth ranking approach opened up a room for further semi-structured interviews with purposely identified households within different socio-economic groups. I used these semi-structured interviews to further obtain specific detailed information about these groups. In this case, out of five main socio-economic groups identified within the participatory wealth ranking exercise in all the villages, at least two members from each group were identified for interviews. As previously mentioned, purposeful selection of these households was done with the help of household data that was obtained during the wealth ranking exercise and from the village offices. In this process, names that were mentioned by wealth ranking participants were used to corroborate and improve the list provided by the village. When triangulating these two methods some names that were missing from the villages' household registers were pointed out by representatives from each sub-village that participated in the wealth ranking exercise and vice versa.

In the interviews I highlighted several key thematic areas that we explored as a point of departure for our discussion. These areas included understanding of their agricultural practices, livelihood, a briefhistory of how they ended up living in the study villages, their perception and involvement in irrigation and other non-agricultural activities. Both the researcher and interview participants were given an opportunity to diverge and pursue further on arising ideas and respond to details. In some cases, the interview touched on issues that were associated with the history of the village, inequalities as well as other challenges that farmers were facing in these study villages. In this aspect, there was flexibility by both the researcher and participants which was important in unveiling new insights for the researcher but also allowing more elaboration from the respondents (Gill, Stewart, Treasure, & Chadwick, 2008). The interviews were able to give me information and further understanding on assets that smallholders own, how the smallholders were investing in these assets and how these investments could vary from one household to the other. What was further important during the interviews is how I was able to grasp an understand experiences of the smallholders on ongoing changes that have been observed within the households but also in the villages at large and different stories behind these changes.

I did most of the interviews in the participants' households and in cases where they were not at home or when I wanted to talk about the farm or irrigation canal we went walking and continued the interviews in the households' fields and along canals (see further below). The interviews were specifically aimed at obtaining insights on understanding livelihood and productive strategies within the household in terms of ownership and access to the means of production including irrigation, how they distribute labour in farming and non-farming activities, how do they access markets, transportation of their products, access to agriculture inputs and different strategies that are used by the household to diversify their income. Smallholders livelihoods, assets, as well as agricultural changes were explored in association with developments

within the village, region and nation at large where questions about historical developments of agriculture and livelihood, history of tenure and change of scales and ownership of farms were posed. The aim was to be able to understand different dynamics and livelihood trajectories that people from different socio-economic groups had experienced over time.

A total of 48 respondents were visited for interviews and observation of some of the criteria that were previously mentioned in the participatory wealth ranking. The total number of household visited were only a few among those identified and these were purposely selected based on gender, age, participation in irrigation (or not) and their inclusion in a particular socio-economic group. Taking into account the fact that I was interested in following up the earlier wealth ranking by Kangalawe and Liwenga (2004) the villages of Idete and Signali were selected for that purpose. In addition to this Njage was added as a village with an older irrigation scheme located further south in the valley. Njage was added so as to be able to see the accumulation strategies and trends related to investments in irrigation specifically and relate them with those identified in Signali and more precisely Sululu village (formerly a part of Signali village) which has a relatively newly lined irrigation scheme. The purpose here was to observe the different livelihood strategies of different wealth groups and relate them with investments agriculture, including investments in irrigation.

Walking interviews

In order to be able to understand the history of irrigation canals and how both irrigators and non-irrigators carry out their agricultural practices in their farms, I did a number of walking interviews. This was aimed to generate data to feed mostly into the third paper on the historical development of irrigation in Kilombero, however, some of the data were also relevant for other papers. Walking interviews took the understanding that the environment in which an interview is done shapes not only the content discussed but also participants' actions and the underlying power relations. Bergeron et al. (2013) citing (Carpiano, 2009; Evans & Jones, 2011) see that the fact that participants become tour guides and therefore lead the way reduces the hierarchical relationship between the researcher and the participants. Bergeron et al. further acknowledge the role that places bring to mind and provoke specific meanings and experiences, that a researcher could not have observed using sedentary interviews or other sedentary approaches (Bergeron, Paquette, & Poullaouec-Gonidec, 2013). In relation to this Evans and Jones are of the view that this type of interview (walking interview) is able to generate richer data due to the meanings and experiences associated with interaction with the environment. This is as the participants are not likely to attempt to give the 'right' answer (Evans & Jones, 2011, p. 849). During these interviews I had to take into account the responsibility of understanding how participants situate themselves in relation to power relations linked to these places, as places are linked to

certain power relations that may influence participants' meanings (Riley & Holton, 2017; Kusenbach, 2003).

I did not have any particular instructions given to the participants during walk interviews in the same way as Bergeron et al. (2013). What I did with participants who were either farmers, canal leaders, extension officers or other local leaders was to walk together along the farms and canals while talking about the history, memories, practices, actors and challenges faced over time. Prior information that I gave my participants was that I was interested in seeing and talking about agriculture and irrigation practices, farmers of different socio-economic groups, accumulation strategies and changes that have prevailed over time. These were main themes guiding the interview which also allowed flexibility among the participants to guide the discussions where necessary (Riley & Holton, 2017).

Walking interviews with sub-village leaders especially within sub-villages that had wealthy farmers who were either not present in the study villages were very insightful. With an aid of a car which we used to reach these areas which were usually far from village centres, we were able to walk around these areas and get an understanding of the prevailing practices as well as being able to get contacts and in some cases appointment with the owners during the process. Hence, I used walking interviews in a way that we connected not only to the places that we walked through but also with other actors that we encountered in the process. A good example of such an encounter was one that I had in one of the irrigating villages where extension services were concentrated in the lined irrigation canals and not in the unlined (farmer-led) irrigation. When I and the village extension officers were walking and talking in the unlined farmer-led irrigation, farmers who were planting rice were very curious to know what we were doing there and asked the extension officer to give them advice and check if they were doing things in the right way.

The need to ensure safety, quality of data captured and timing of walking interviews are some of the practical issues that should be considered in walking interviews (Riley & Holton, 2017). It is pointed out that there could be possibilities of injuries specifically when walking over areas that one is unfamiliar with, quality of data may be jeopardised by possibly distance or other noises when walking, and issues of seasonality and time when the interview is scheduled are of importance. In our case, these were areas that my participants were aware of and familiar with, however as a pre-caution especially when walking in flooded areas and across streams of water we usually had gum boots with us, and in some areas we had to go with a car to both save time avoid possible threats to safety. To ensure the quality of data, I used a high quality small recorder that was able to capture the conversation and a GPS to trace our movement and map lined canals while walking. I did fieldwork mostly during the dry season. As previously mentioned this the season when the area is not flooded and therefore possible to navigate around while

walking with participants. Consideration of seasonality was also done. Harvesting seasons and seasons where dry irrigation farming was done were purposely selected as an important time in which walking interviews could be done. This consideration of seasonality alongside other practical choices made here aimed to address the aforementioned practical considerations.

Questionnaire survey

I used a questionnaire survey so as to be able to further analyse inclusion and exclusion and other processes and dynamics in smallholders' irrigation investments. The data obtained were mostly aimed to develop paper 3. The questionnaire was based on the previous explorative qualitative study that suggested that within the study villages there were geographical differentiation that was taking place, where there were areas, specifically with people who are irrigating, that were better off compared to other areas. Given the power asymmetry in questionnaires as a method and its possibility of turning respondents into mere statistics (Cahill, 2007), I combined it with interviews with a selection of the respondents' to clarify some of the responses that were mentioned during the questionnaire surveys so as to capture experiences and perceptions on inclusion and exclusion in irrigation.

A total of 244 respondents in four villages (Msolwa Ujamaa, Sululu, Mkula and Njage) were interviewed and included in questionnaire survey, with about 60 respondents in each village. Selection of villages were purposely done on the basis of the presence of a lined irrigation canal, where all villages had a lined irrigation canal. This was followed by a stratified random sampling which I did in each village, where selection of respondents was done on the basis of their residence within a particular sub-village. Residence within a particular sub-village was a crucial strata given the assumption that some sub-villages are likely to benefit more from irrigation compared to others. Within each sub-village, the list of households within the sub-villages were compiled with the help of both sub-village and village leaders. In each sub-village the number of households selected depended on the number of sub-villages within each village. The village with the maximum number of sub-villages was Njage with a total of 6 sub-villages, while Sululu only had 3 sub-villages. Households were given numbers and a few were randomly selected to participate in the study.

With the help of research assistants, translated questionnaires were filled by interviewing the respondents in Swahili. I translated the questions beforehand to Swahili so as to reduce possible inconsistence that could have arisen if translated by the research assistants. The aim of using questionnaires as a method was to get additional quantitative data on; first, the extent and type of irrigation commonly used and how this benefits people; second, to distinguishing processes in irrigated and rainfed cultivation so as to understand the inclusion and exclusion processes; third, to get socio-economic data that could be used to understand and distinguish the irrigated and rainfed cultivation.

Data analysis

Interviews and wealth ranking data were transcribed and translated from Swahili to English with an aid of my research assistants in some cases. While some of the themes emerged already in the field, others were identified during the process of reading through and analysing and coding the translated transcripts. Coding was done so as to be able to highlight key themes (Cope, 2006). In this case, analytic codes were highlighted where the themes that were relevant to my study as they reflected the processes that highlighted the agricultural dynamics and social differentiation processes were developed. The wealth ranking data was used to establish different socio-economic groups among the smallholders and as an entry point for interviews. In this case, Interviews were also organised according to the socio-economic group that they belonged so as to capture the recurrent themes that helped to understand the dynamics within the group as they described their agricultural and other non-agricultural practices.

Quantitative analysis was done using SPSS whereby I coded, cleaned data and run initial descriptive analyses. The aim of the initial analysis was to get a general understanding of the data. Further analysis was done by my co-author during the development of the paper where regression analysis and chi-square analysis was done so as to understand the differences between the irrigating and rainfed practices by the smallholders. We have presented the quantitative findings in paper 3 focussing on farmer-state-market interactions. Moreover, the descriptive statistics developed were further used to understand the differences that prevail between different types of irrigation (i.e lined, unlined, shallow wells and bucket) and also to better understand some of the socio- demographic data which were linked to either irrigation or rainfed cultivation and to relate this data with individual experiences.

Reflexivity

Reflexivity in research is described by (Palaganas et al., 2017 citing Parahoo, 2006) as a process in which a researcher is able to reflect on their subjectivity in terms of how their values affect the research process. It involves how we are able to recognise, analyse and make sense of our social background (socio-economic status, cultural background, political orientation and demographic characteristics), and how location and assumptions influences our research practices (Hesse-Biber, 2007 as cited by Palaganas et al 2017). It brings our role as researchers in the centre of analysis as we consciously understand how we affect and are affected by the research process. Reflectivity is further concerned with interpersonal relations that we have with our participants and associated asymmetrical power relations, that constitutes the process where the perceived knowledge we have could in itself be seen as directly or indirectly powerful (Kvale, 2002; Dowling, 2016). This is thus about negotiating a path

through a problematic self-analysis and self-disclosure, while confronting different power relations inherent in all social relations from reciprocal relationships with minimal differences to asymmetrical relationships and potentially exploitative relationships (Finlay, 2002; Dowling, 2016).

Reflexivity according to van de riet (2012) as cited by Palaganas et al. should also involve the awareness on the possibility of what she refers to as the "Hollywood plot" when participants wants to say what we want to hear and how researchers may influence what they want to hear. For example, when I started transect walks of irrigating villages and did walking interviews in the irrigation canals I was initially given an impression that some of these canals were not working. At that time, I was with my supervisors and other PhD students from our project. I could clearly remember how one of my supervisor was amazed when we came to see it working despite some of the maintenances that were done by the villagers following the destruction of some of the lined walls of the Sululu canal by the heavy rains in 2016-2017 season. This was partly a result of my (maybe also our) previous assumptions that there could be 'failed' irrigation schemes following numerous literature that highlights the challenges of these schemes but on the other side it could have been escalated by our 'travellers' status escalated by 'whiteness' of our supervisors who were in the field with us at that time. These assumptions could have in one way influenced the misrepresentation of the problem on the part of the participants but at the same time misinterpretation on my and in this case, our part. In this case, I will talk more about my positionality and how I plan to share my findings.

Positionality

Being a Tanzanian, middle class, middle aged male, employed in a public university and doing my PhD in a university abroad, my position during this study was fluid and in some cases contradictory. Doing research within Tanzania, my assumption was in a way that I am partly an insider and some way advantaged. But at the same time my assumption was also that I do not know much about the livelihoods as well as agricultural dynamics in the area, so I am therefore an outsider with the same ethical issues as well as hierarchical challenges that any outsider is expected to consider during research.

My perceived assumptions of an insider could be associated with my knowledge of 'swahili', a language that is spoken everywhere in Tanzania by approximately 90% of the Tanzanian population (Laitin, 1992, p. 140; Ngonyani, 1995), but in another way because I am familiar with some of the cultural practices including food, therefore not susceptible to much of a cultural shock during my fieldwork. However, as Howitt and Stevens argues, there were other cultural differences similar to what they refer to as "complex dimensions of diversity" (Howitt & Stevens, 2016). Hence, at the same time that I would feel that I am an 'insider' through swift communication,

knowledge of bureaucracies and a general familiarity with housing, food and culture, I was at the same time an outsider

My position as an outsider was, for example, visible as people perceived me as an expert ('mtaalamu' in Swahili). Following an argument by Cahill (2007) on critical reflexivity, it is not a matter of how one identifies oneself, but rather how you are seen by the society. Cahill further links identity that arises from this as linked to inequality, citing Ginwright and James (2002, p. 36) she points out that our identity attracts some forms of power and privilege and therefore a basis for inequality. Identities such as being white, or middle class, male and heterosexual attract more power and privilege than other identities (Cahill, 2007, p. 274). In this case, being seen as an expert was associated with particular power and privilege. I was expected to have answers and solutions to particular crops diseases, pests, and delays in supply of agricultural inputs which in most cases I didn't have on the bases of my academic background.

Kilombero valley in general has a long history of agricultural interventions, conservation and other activities that have attracted a number of outsiders and experts travelling into the area. During my stay in the field I came across and heard about a number of such experts ranging from those coming from government organisations, such as the irrigation commission and ministry of lands, to research institutions such as Sokoine University of Agriculture and Kilombero Agriculture Training Institute (KATRIN) in Ifakara, to NGOs and International organizations such as the USAID, Caritas, World Bank and European Union to mention a few. These were separate from the experts that were coming as investors in the area such as Kilombero Sugar Company (KSCL), Kilombero Teak Company and Kilombero Plantations Limited as well as other financial companies that sent experts to talk to the people about agricultural loans and insurance. These experts have always had with them some kind of knowledge to offer to the farmers and in some cases solutions to some pertinent problems, but in some cases as some of my respondents complained that; they give them hopes and disappear.

Some of the previous research in the area have also been associated with interventions and introduction of new crop varieties, carrying with it this tendency of either offering a solution or giving hopes to the farmers. In my case, I came across questions from participants on how this study was going to help them. With most of these questions coming from participants older than me, it gave me the feeling that my age helped in some cases to reveal more power among those who were younger than me but also did vice versa on those who were older than me. In most cases, re-identifying myself as a student and explaining how collected data are going to be used by me and others for teaching, further research or decision making and that feedback will be provided, worked well as a way to inform the respondents about my presence and research activities. With a sense of obligation and honesty towards the people I interacted with in the field (Campbell et al., 2006), I mentioned in most cases

that the findings are possibly not likely to bring immediate benefits to them, a gesture that was not always satisfactory. It was at least clear for me in this aspect that I as a researcher had distinctly different interests to what respondents had and what they expected form me. While I, as a researcher or outsider expert, may for example care about general global issues and generalization of patterns and processes, the people I met during fieldwork were primarily concerned with day to day issues and the immediate problems they were facing (Årlin et al., 2019).

The fieldwork was organised through the use of multiple gatekeepers providing a variety of resources (ibid, 2006, p. 103). Financial resources were provided by Sida (the Swedish International Development Cooperation Agency through Stockholm University and the University of Dar es Salaam (UDSM), where the latter was responsible for my research permit and logistics to the field. Logistics in this case referring to a car and driver, made it easier to access some of the areas that could not be easily accessible given the roughness of the roads and distance from the centre of the village. At the same time, the drivers also acted as gatekeepers as they had knowledge of some of these areas given their prior visits in these villages. Drivers in a number of occasions, knew either places or some of the persons that we were supposed to visit. Within the study villages my main gatekeepers were the village leaders, extension officers, irrigation leaders, research assistants and some of the farmers. In numerous occasions these persons helped me to locate people and places and provided me with initial information and specific (agri)cultural insights.

The need to have a reflexive analysis of my fieldwork specifically on the role that gatekeepers played reflects what Campbell et al. (2006) identifies as the complex relationship that exists between researchers and gatekeepers. This complex relationship arises contrary to the how this relationship has been portrayed as unidirectional and therefore beneficial to researchers. However, when the power relations are reversed this is not usually the case. This is where the complexity of this relationship may arise and may sometimes manifest itself as a restriction of choice of methods that a researcher is likely to use or as some other ethical challenges (ibid). My choice of methods for example and my field timing (seasonality) were in some aspects influenced by my access to fieldwork equipment and other resources from UDSM. At the same time, my use of the university car was telling my interlocutors in the field about as my relationship to the government. In some cases, some of the respondents specifically some from the wealthier group where I had to use a car could hide or refuse to say anything until they knew that we were there for research purposes. In some cases, I would have preferred to stay longer in the field to carry out more tasks, but were constrained by a respect for the work schedules of the drivers or some of the gate keepers that I needed for fieldwork or for lack of sufficient resources.

A comment on research ethics

For the purpose of sharing the information obtained so as to avoid a purely exploitative research practice where a researcher just to extract data and leave, I will do a feedback visit soon after my PhD defence where I will have group discussions with the purpose of sharing research results in the villages where I did the fieldwork. With a purpose of qualitative inquiry to reduce the hierarchical relations as well as sharing of meaning-making (Pawson & DeLyser, 2006) I intend to translate and discuss my research findings and how they are associated with irrigation, but also discuss different experiences within the villages on inclusion and exclusion in irrigation smallholder irrigation. Brief summaries of findings in the local Swahili language with a summary of history of irrigation in the area, as understood from my point of view, are to be shared and discussed with the aim to share views on findings locally and stimulate further discussions (Årlin et al., 2019).

To adhere to the ethical requirements, I attained a research clearance from the University of Dar es Salaam so as to do the field research. The ethical clearance was provided and letter were written to relevant region, districts and institutions so as to introduce me and allow me to conduct the study. Provision of the clearance was also made to ensure that there is no sensitive information that will be collected during the study. In this case, this study did not directly or indirectly collect any particular information associated with religious, ethnic affiliations or any sensitive information about the respondents. Anonymity of the respondents and confidentiality was adhered to as all the individual information such as names were separated from the actual questionnaire surveys by adding codes to the questionnaires rather than actual names. Therefore, the study followed standard ethical guidelines including those on voluntary participation, anonymization, and informed consent.

5. Overview of the papers

I have made different kind of contributions on the papers listed in this section as follows; In **paper 1**, my main contribution was on the conceptualisation of the paper, mapping of the canals, interviewing on the historical development of the irrigation canals, and analysis and reporting of the qualitative data. This paper has already been published in Frontier in Environmental Science Journal. In **paper 2,** my main contribution was in the conceptualisation of the paper, data collection (with help from Emma Liwenga in wealth ranking), data analysis, and paper writing. This paper has been submitted and is under review in Journal of Agrarian Change. In **paper 3,** my contribution was in the conceptualisation of the paper, research design, data collection, analysis of the qualitative data and paper writing. This paper has been submitted and is under review in Water Alternatives. In **paper 4,** I am the single author. This paper is presented as an unpublished manuscript in the thesis and will be further edited and submitted to a journal after the thesis defence.

Paper 1

Alavaisha E, Mbande V, Börjeson L and Lindborg R (2021) Effects of Land Use Change Related to Small-scale Irrigation Schemes in Kilombero Wetland, Tanzania. Front. Environ. Sci. 9:611686. doi:10.3389/fenvs.2021.611686

Abstract

Increasing agricultural land use intensity is one of the major land use/land cover (LULC) changes in wetland ecosystems. LULC changes have major impacts on the environment, livelihoods and nature conservation. In this study, we evaluate the impacts of investments in small-scale irrigation schemes on LULC in relation to regional development in Kilombero Valley, Tanzania. We used Remote Sensing (RS) and Geographical Information System (GIS) techniques together with interviews with Key Informants (KI) and Focus Group

Discussion (FGD) with different stakeholders to assess the historical development of irrigation schemes and LULC change at local and regional scales over 3 decades. Overall, LULC differed over time and with spatial scale. The main transformation along irrigation schemes was from grassland and bushland into cultivated land. A similar pattern was also found at the regional valley scale, but here transformations from forest were more common. The rate of expansion of cultivated land was also higher where investments in irrigation infrastructure were made than in the wider valley landscape. While discussing the effects of irrigation and intensification on LULC in the valley, the KI and FGD participants expressed that local investments in intensification and smallholder irrigation may reduce pressure on natural land cover such as forest being transformed into cultivation. Such a pattern of spatially concentrated intensification of land use may provide an opportunity for nature conservation in the valley and likewise contribute positively to increased production and improve livelihoods of smallholder farmers.

Keywords: land use/land cover, small and large scale, irrigation scheme, wetland, conservation

Paper 2

Growing from below: Accumulation and differentiation in publicly supported irrigation schemes in the Kilombero Valley, Tanzania

VICTOR MBANDE, LOWE BÖRJESON AND EMMA LIWENGA

Abstract

What model of agricultural transformation is most likely to produce the best possible conditions for inclusive growth and increased productivity in Tanzania's diverse smallholder sector? A response to this question must rely on studies that examine the outcome of local agricultural investments. We notice that there is limited information and studies that specifically examine the role of small-scale public investments in irrigation infrastructure in the country. To address this gap, we have examined the social differentiation and patterns of accumulation in the context of donor-supported public investments in irrigation schemes at sub-village level in the Kilombero Valley, Tanzania. Participatory wealth ranking and interviews carried out indicate that the investment made in small-scale smallholder irrigation has fuelled a process of accumulation from 'below', and we discuss how these investments are more likely to contribute to the policy goals of inclusive growth and improved agricultural productivity than the accumulation from 'above' model.

Keywords: Social differentiation, wealth ranking, irrigation, smallholders, capital accumulation

Paper 3

Becoming a progressive farmer: Farmer-State and market interactions in improved smallholder irrigation in Kilombero valley, Tanzania

Victor Mbande and Edmond Alavaisha

Abstract

Studies on irrigation development in Africa point to a large potential in smallholders' irrigation. Nevertheless, policy efforts prioritise transformation through private (large-scale) capital rather than small-scale smallholder irrigation. Using a mixed-methods approach, this study contributes to the understanding of internal dynamics among smallholders in irrigation from four irrigating villages in Kilombero, Tanzania. We focus on public investments in village-level smallholder irrigation and show how the word 'tija', a local discourse of progressiveness, is widely used in the current efforts to commercialize rice production through irrigation, but also closely linked to emergence of the so called 'progressive farmers' as a desired development outcome of irrigation policy. Building on the literature on farmer-led irrigation development, we analyse a case of both farmer-led and state supported irrigation. The farmers initiated irrigation by digging unlined canals which attracted state supported investments in lining canals. Dynamics in irrigation were rooted in the ideas and practices of progressiveness and differentiatiation among smallholders. We conclude that, this study shows how state interventions can improve farmer-led initiatives as the state-market-smallholder interact. Aspirations for progressiveness were also embedded in the interaction as current market interventions and ongoing public investments in lining smallholders' irrigation which preferred the entrepreneurial 'progressive farmers'.

Keywords: Progressive farmers, smallholders, irrigation development, rice productivity, Kilombero.

Paper 4:

"If you irrigate it has to be rice": Smallholders' strategies in a 'domestic rice boom' in Tanzania

Victor Mbande

Abstract

This study focuses on micro, village level analyses of the role of rice in smallholders' small-scale irrigation and agriculture commercialization in Kilombero, Tanzania. Rice commercialization has been central in agricultural planning in the country as 'booming' rice production has led to a question of rice as a 'boom crop'. Building on the processes of 'accumulation from below', I problematize the notion of 'rice boom' in Kilombero so as to unpack how the role of differentiated smallholders in irrigation is shaped around specific crop boom markets in the current commercialization dynamics in Tanzania. Findings from interviews and wealth rankings indicate that rice has been at the centre of wider dynamics in Kilombero with multiple state and non-state actors involved to offer increased market linkage. Similarly, farmers were of the view that these actors carry with them a strong connotation that 'if you irrigate it has to be rice'. This connotation is embedded in the current efforts to revitalize and commercialize smallholder irrigation in Kilombero. Similarly, rice commercialization practices were seen as building on existing efforts among differentiated smallholders, and different agricultural and non-agricultural assets were mentioned by respondents as crucial for them to irrigate and get extra income. Therefore, I discuss how smallholders offer a response to a 'crop boom' and why processes of 'accumulation from below' and micro-level dynamics are crucial to understand in relation to larger-scale crop boom politics and price dynamics.

Keywords: Rice, domestic crop boom, irrigation, smallholders, Tanzania, Kilombero.

6. Conclusion

The aim of this study was to critically explore processes of accumulation from 'below' among smallholder irrigation farmers in Kilombero river valley in Tanzania. The focus was to understand how inclusive the prevailing public investments in smallholders' small-scale irrigation are, and how likely they are to produce the best possible conditions for smallholders' model of agricultural transformation. The study problematizes the general conception within agriculture and irrigation policies that smallholders are homogenous and contributes to the empirical and conceptual understanding of the social differentiation processes in smallholder irrigation as part of the internal dynamics among smallholders. The study used Kilombero Valley as a case study and had three main sub-studies within Kilombero district; The first sub-study is a revisit in villages that previous wealth ranking by Kangalawe and Liwenga (2005) was conducted and the study contributes on history and development of irrigation within the irrigating villages; The second sub-study is on the selected irrigating villages with a focus on the processes of inclusion and exclusion in irrigation and the interaction between the state, market and smallholders in irrigation investments; and the third sub-study is on the role of rice in irrigation where the question of a domestic smallholders driven rice boom in Kilombero is also analysed.

The findings contribute to the understanding of social differentiation among the smallholders in the context of ongoing public investment in small scale smallholder irrigation usually at the village and sub-village levels. While commercialisation remains one of the main driving forces of the current smallholder dynamics in Tanzania, more specifically, this study highlights how the smallholders' initiatives in irrigation interact with market stimuli and state interventions in the current agricultural transformations, and how rice as a commercial booming crop shape smallholders' irrigation development. Generally, findings indicate that investment made in small-scale smallholder irrigation has fuelled a process of accumulation from 'below' as they benefit small-middle smallholders rather than the large wealthier farmers and therefore points to the importance of focusing on smallholders' in agriculture and irrigation development for a more inclusive agricultural transformation.

What is the historical development of smallholders' small-scale irrigation in Kilombero?

Findings from this study indicate that most lined (improved) irrigation canals within the study villages in Kilombero started as a 'farmer-led' initiative by the smallholders from the 1970s to 1980s. Smallholders developed such canals through blocking water with sand bags in the river so as to create a weir and intake and then dug earthen canals to divert the water from the main stream towards their farms. This is with exception of Msolwa Ujamaa which started as a training school started by the Chinese trainers that had settled in the village during the socialist period (from 1960s to mid-1980s). The timing for the initial developments of the canals was influenced by numerous socio-economic and political developments in the 1970s including the village settlement schemes through 'Ujamaa and villagisation', construction of Tanzania – Zambia railway (TAZARA), and the introduction of Kilombero Sugar Company Limited (KSCL) which spurred immigrations into the Kilombero valley. Central to these initial irrigation developments by the smallholders in Kilombero was the need to diversify their agricultural portfolio by venturing into dry season irrigation. Dry season cultivation of maize commonly known by the interviewees as 'chalula' was mentioned as the primary target among those irrigating in most of the irrigating villages.

Findings further shows that land use in irrigated areas increased sharply compared to the non-irrigated areas after privatisation of KSCL in the 1998. Increased cultivation for the market, and construction of irrigation infrastructures were mentioned by the key informants and focus group discussion participants as important for this development. The focus group participants stressed that privatisation of KSCLand the increased share of sugarcane outgrowers in the villages, contributed to land use change and influenced the need for rice irrigation in villages close to Ifakara town (Msolwa and Mkula), explaining the difference in timing of land use changes between these villages and Njagein the inner part of the valley. In contrast, informants mentioned the establishment of Kilombero Plantations Limited (KPL) in early 2000s as an important start of the modern, intensive rice farming system in the southern part of the valley including in Njage.

Therefore, findings indicate that the development of smallholders' unlined irrigation canals has attracted the attention of the state, and some of the smallholders were of the view that this support was in some cases sought for by the smallholders as they looked for means to expand irrigation development. On one hand, this points towards the increased potentiality of the smallholders' initiatives in irrigation development, but on the other hand it points towards the need for policy focus on smallholder irrigation that builds on processes of differentiation among the irrigating and non-irrigating smallholders and also the efforts of the smallholders. Therefore, the need for improved irrigation

among the smallholders and increased land use in the irrigated areas compared to the wider valley was linked to more productivity within small plots of land which was regarded useful for both conservation of the valley and for more sustainable irrigation to safeguard crop production, as a well-functioning irrigation systems has the potential of doubling the yields of rice per hectare.

How have public investments in smallholders' small scale irrigation influenced accumulation and social differentiation processes in Kilombero??

Finding of this study further shows that there were five (5) main socio-economic groups that were ranked during participatory wealth ranking. These included wealthy farmers, upper middle farmers, middle farmers, lower middle farmers, and low-income farmers. Among these groups, irrigating smallholders were mainly those from the middle farmers group of smallholders. These were mostly benefiting directly from irrigation infrastructures as they were able to both access and use the irrigation canals by cultivating efficiently. These middle smallholders included those who resided within the study villages and were focused on increasing yields in relatively small plots of land close to the village centres.

In non-irrigated areas, other socio-economic groups were common such as a group of wealthier farmers who were mainly cultivating extensively in larger tracts of land using their tractors and other equipments. These wealthier farmers did not prefer irrigated areas which require more intensive cultivation. Likewise, most of the lower middle and low income smallholders were only partly irrigating and some were renting out their irrigated areas as most of them had to work for other wealthier farmers so that they could get income for their daily needs and capital they could use in cultivation. While other social economic groups did not directly benefit from irrigation, social differentiation through irrigation was enforced by the rental and labour market as some of the smallholders had to rent out and work in the irrigated areas. The wealthier farmers also benefitted in rice processing and storage of the rice harvested from the irrigated areas.

Public investments in irrigation infrastructure enabled more smallholders to irrigate in lined canals, and further expansion has been called for due to the rising yields and also prices of land in the irrigated areas. In this case, public investment in smallholder irrigation had also an implication for processes of accumulation from 'below' as smallholders strive to increase rice yields, buy and sell land and farm labour, enter into farm and non-farm diversification, and renting out farmland. In the irrigated areas farmers were under pressure to either 'improve' or 'move out' which generated internal differentiation among smallholders as some accumulate, while others could not. However, the internal differentiation was perceived to be more inclusive among the

broader spectrum of middle group 'from below accumulators' compared to in the non-irrigated (rainfed) areas where polarisation between the wealthier farmers accumulating from 'above' and the 'farmworker' group was a more clear pattern. As the policies in irrigation tend to disregard the smallholders' initiatives, the findings suggest a gap between inclusion policies and the actual dynamics among the smallholders.

In what ways are the smallholders' farmer-led initiatives interacting with state policies and market stimuli in irrigation development in Kilombero?

Policies surrounding public investments in smallholder small scale irrigation were driven by the assumption that smallholders are largely undifferentiated. In this case, the term 'progressive farmers' was used to describe the canals that could be targeted by these irrigation investments. Findings in Kilombero show that 'progressiveness' in irrigation was linked with smallholders' initiatives as they responded to both the market stimuli and public interventions. Becoming a 'progressive farmer' was linked by interviewees with the concept of 'tija', a local discourse of progressiveness associated with increased productivity or efficiency, mainly through irrigation development and other practices initiated by smallholders as they responded to market stimuli including irrigating in the dry season. However, the irrigating smallholders were also differentiated and there were some smallholders who owned land in the irrigated areas and were unable to cultivate for numerous reasons mainly associated with costs of such cultivation, so they were forced to rent out their plots of land in the irrigated areas.

Differentiation among the irrigating 'progressive' farmers was associated with processes of inclusion and exclusion in irrigation. While those smallholders who owned land in irrigated areas, but who could not cultivate, were excluded from irrigation, the same process allowed access to some of the farmers who could irrigate but did not own land in the irrigated areas. However, investments in smallholder small scale irrigation were built on 'farmer-led' initiatives of the smallholders, and therefore these investments were perceived to be more inclusive as they were not associated with land grabbing during the improvement and expansion of irrigation schemes, as the smallholders were able to keep their land. The differentiation among the smallholders was based on internal differentiation among the themselves through a processes of accumulation from 'below'.

Findings also shows that while the majority of the irrigating smallholders were men, the number of women in irrigation was higher compared to that of women farmers in rainfed cultivation. This is despite the fact that there was no redistribution of land in areas under irrigation even after improvement of irrigation investments and that women are more likely to be excluded from the

means of production as they are neither allowed to own land nor to irrigate and in other cases they are excluded in managing the canals and decision making on how to cultivate. As access and use of irrigation water was dependent on who is able to own or rent the land, and keep it in production in a relatively efficient way, women who could source capital in other agrarian and non-agrarian activities were also able to invest in irrigation cultivation. In this case, the role of capital in smallholder irrigation is also linked to how farmers in irrigated areas were responding to market opportunities.

In Kilombero, irrigation developed prior to current improvement interventions focused on 'progressive farmers', nevertheless, this study shows that aspirations for progressiveness are strongly embedded in the current market interventions. These aspirations also follow ongoing public investment in lining smallholders' irrigation canals as they aim to stimulate market demands and support entrepreneurial 'progressive farmers'. In this case, analysis of the processes and practices associated with 'tija' or progressiveness among irrigating smallholders indicates that the interactions between smallholders, state and market are embedded in the current quest for increased rice productivity through irrigation.

What is the role of rice intensification and commercialisation in smallholders' small scale irrigation in Kilombero??

Findings of this study further points to the ongoing domestic smallholders' rice boom in Kilombero. On one hand, differentiated smallholders producing for the market were playing a crucial role in both increasing value of rice, increasing productivity, and providing much needed labour. On the other, the wealthier farmers were more linked with different value addition activities in the rice value chain. Similarly, the role of agro-pastoralists is also notable as they have made ox-driven ploughs common in Kilombero and have partly helped to reduce negative perceptions that farmers previously had towards pastoralists. Generally, differentiated smallholders were in different ways driving the 'domestic rice boom' in the area as rice is increasingly commercialised in Kilombero.

Moreover, findings points to a crucial and increasing role of rice in irrigation investments in Kilombero. Both interviewees and participants during wealth ranking were of the view that the current irrigation interventions in Kilombero are widely focused on rice productivity. The smallholders further pointed to the fact that numerous regulations have been introduced within the irrigated areas that requires strict rules of rice cultivation mainly instructing the smallholders to cultivate by following some of the procedures for the System of Rice Intensification (SRI). Interviewees were of the view that these regulations carry a strong embedded discourse with them that 'if you irrigate,

it should be rice'. Even in villages such as Sululu where irrigation development was associated with other crops such as bitter tomatoes and okra farmers have currently moved to rice, specifically during and after improvement of the canals. Therefore, this study shows that while smallholders offer a response to a 'domestic boom', the role of rice in smallholders' small-scale irrigation remains crucial and influences the micro-level dynamics and processes of 'accumulation from below' which are crucial to understand in relation to larger-scale crop boom politics and price dynamics.

7. Sammanfattning på svenska

Denna doktorsavhandling behandlar differentierings- och ackumuleringsprocesser kopplade till offentliga investeringar i bevattningsanläggningar som nyttjas av jordbrukare i Kilombero distriktet i Tanzania. Syftet med bevattningsanläggningarna har varit att utveckla och förbättra förutsättningarna för det småskaliga jordbruket, främst med avseende på produktion av ris, i området. Syftet med avhandlingen är att undersöka betydelsen av dessa offentliga investeringar för jordbruksutvecklingen i området, med fokus på differentierings- och ackumuleringsprocesser bland jordbrukarna. En central fråga är vilka jordbrukare som har gynnats av dessa offentliga investeringar i småskalig bevattning och hur utvecklingen i området förhåller sig till uppsatta politiska mål om fattigdomsminskning i Tanzania.

Avhandlingen bygger på data som samlats in från byar både med och utan bevattningssystem med syftet att undersöka övergripande förändringar i området och hur konstbevattning bidrar till jordbruksutveckling och differentiering bland jordbrukare. En kombination av metoder användes. Framförallt bygger avhandlingen på en kombination av rankning av de olika hushållens ekonomi och tillgångar, intervjuer, fokusgruppsdiskussioner och en enkätundersökning.

Avhandlingen består av fyra artiklar och en inledande kappa. Studien problematiserar en vanlig föreställning inom jordbruks- och bevattningspolitiken i Tanzania om att de som bedriver småskaligt jordbruk (småbrukare) är en relativt homogen grupp. Avhandlingen använder teorier om "ackumulation av kapital och tillgångar från ovan" och "ackumulation av kapital och tillgångar underifrån", för att analysera utveckling och differentiering bland småbrukare. Genom att följa ackumuleringsprocesser bland småbrukarna kopplar studien samman offentliga investeringar i småskalig konstbevattning med processerna för "ackumulering underifrån". Resultaten av denna avhandling visar att redan existerande skillnader mellan olika jordbruk har betydelse för vilka som gynnas av offentliga investeringar i småskalig konstbevattning. I samtliga bevattningsanläggningar som studerats i avhandlingen gjordes den initiala utvecklingen av bevattningskanaler av småbrukare genom egna initiativ, dvs som en form av jordbrukarledd bevattningsutveckling. Denna utveckling kan spåras huvudsakligen till slutet av 1970-talet och början av 1980-talet, och bidrog till att locka till sig offentliga investeringar i form av fler och längre bevattningskanaler byggda i betong under 1990-talet och framåt. Det var dock inte förrän

i slutet av 1990-talet till början av 2000-talet som det har skett en ökad odling i de konstbevattnade områdena. Ökningen föregicks av en liberalisering av den tanzaniska ekonomin sedan slutet av 1980-talet och en ökad privatisering av jordbruket i området från 1998 – en utveckling som också har medfört att jordbrukare blivit alltmer differentierade.

Avhandlingen visar att de rikaste jordbrukarna och största markägarna i området mestadels brukade stora arealer utan tillgång till investeringar i konstbevattningsanläggningar, medan de flesta av jordbrukarna med en för området mer normal hushållsekonomi var de som framförallt använde konstbevattningsanläggningarna och därmed drog nytta av de offentliga investeringarna i småskalig bevattning. En slutsats som dras är att utbyggnaden av småskaliga bevattningssystem för risodling i Kilombero har haft betydelse för utvecklingen i området, inte minst eftersom ris är både en nationellt viktig livsmedels- och kommersiell gröda. Sammanfattningsvis diskuterar avhandlingen hur investeringarna i småskalig konstbevattning bidragit till processer av "ackumulering underifrån" som drivit på en utveckling och differentiering bland små och medelstora jordbrukare, samtidigt som utvecklingen i omgivande regnbevattnade områden har präglats av en mer tydligt polariserande differentiering där dels kapitalstarka jordbrukare och dels lantarbetare utan egen tillgång till mark har etablerats som två nya ekonomiska klasser i området sedan mitten av 2000-talet. Resultaten av avhandlingen visar på betydelsen av offentliga investeringar i jordbruk- och bevattningsutveckling som riktas till småbrukare och på behovet av att studera småbrukares möjligheter att dra nytta av offentliga investeringar som syftar till en inkluderande jordbruksutveckling.

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Appendix

Figure 4. Farmer field school 'Shamba darasa' in Msolwa Ujamaa irrigation scheme

Figure 5. Irrigated fields in Njage

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Figure 6. Drying rice ready for processing in Ifakara town

Figure 7. Migrants Sukuma agro-pastoralists using cows to transport rice from their fields in Signali