Field Work Final Report

Case Study:

Dakawa Rice Farm- small-scale irrigated cooperative rice production

By Anna Mdee, based on data collected by Christopher Mdee, Erast Samwel and Elias Bahati

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Introduction

This case study explores the case of Dakawa Rice Farm- a former state rice farm (constructed by the North Koreans) but now co-operatively managed by a water users' association of small rice farmers. The process of the scheme's evolution is detailed in this report. The case was selected as it stands of an example of Tanzania's current approach to developing irrigated agricultural production. It relates well to the implementation of Kilimo Kwanza ('Agriculture First') and to the 'Southern Agricultural Growth Corridor (SAGCOT) initiatives of the Tanzanian Government.

Dakawa Rice Farm appears to have been the site of repeated aid interventions throughout its history and is currently the focus of USAID and Chinese projects. The farm has a chequered political history but is currently a 'pin-up' example of how irrigated rice productivity can benefit small farmers in terms of improving their productivity and increasing their incomes.

The case is relevant for this research for the following reasons:

- There is an interesting underlying tension as to the viability of irrigated rice production in the rice farm- given the high costs of pumping water from the Wami River and the low level of the river.
- The idea of 'smallness' is a contested theme within the discourse- this has important links with fairness, trust and transparency in the formal management of the scheme.
- The high level of aid intervention suggests a complex politics of rice production and agricultural intervention in Dakawa, with implications for how donors support such initiatives.

Methodology

This report is a first attempt to analyse, synthesise and identify thematic issues emerging from data collected in the Dakawa Rice Farm.
The research questions were guided by the University of Sussex Team.

Initial field visits in May confirmed the selection of Dakwa as a potentially interesting case study. Several observational and environment scanning visits took place in June and July. A number of key informant interviews were also conducted to build up an awareness of discourse concerning agriculture, water and irrigation at the Dakawa Rice Farm.

A baseline survey of farmers created by Canford Chiroro was slightly modified and translated into KiSwahili by Chris Mdee. Chris Mdee, Erast Samwel and Elias Bahati conducted interviews with 115 Farmers in July 2013. Chris Mdee collated the results of this survey- these are provided in appendix 3.

This was used to inform the selection of 15 Farmers for more extensive semi-structured interviews.

Key informant interviews were conducted in the period from May-December. These include respondents from Wami-Ruvu River Basin Office, USAID project-funded staff, Dakawa Rice Farm Officials, Chollima Rice Institute Officials, Academics from Sokoine University of Agriculture and staff from NGOs. Some respondents have been interviewed formally in an office setting, others more informally over the course of conversation in more social locations. A list of interviewees is included in Appendix 2.

This case study has also been informed by participant observation during other research activities during September, October and November 2013.

Another useful source of data comes from interviewing the Research Team- Chris, Erast and Bahati as to their impressions, stories and experiences during the data collection. Chris Mdee also conducted interviews on the financial aspects of rice production with a selection of 10 Farmers from the original group of interviewees. This data will be presented as part of a Masters dissertation but is referred to in this report. The dissertation will also be available to this project to inform the final outputs.

Two small FGD took place, one with a group of 3 Farmers and one with a staff team from the Dakawa Rice Farm Office.

All interviews were conducted in KiSwahili and were simultaneously transcribed and translated into English. Interview notes are scanned and stored using dropbox. Most interviewees were not comfortable with audio recording.

Dakawa Village, Mvomero District

General description

1.1 Location & Physical Geography

Dakawa is a settlement located approx 40km from the City of Morogoro on the road to Dodoma. It is in the Wami-Ruvu River Basin and sits close to the Wami River (see figure 1 below). It is the site of one of the largest irrigated rice schemes in Tanzania, with 2000 hectares of paddy.

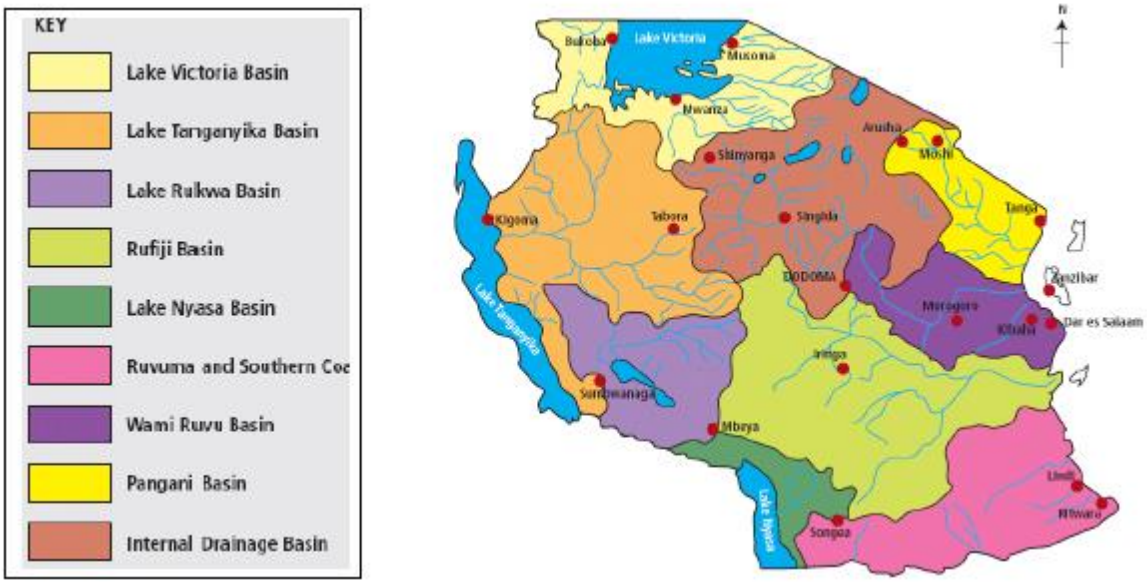

Figure 1- River Basins of Tanzania
Source: URT (2007)

Rainfall is bi-modal with the long rains in the March-May period and short rains from October-December. Climate data was obtained from Sokoine University of Agriculture and is collected in partnership with the Tanzanian Meteorological Agency. Data is only available for Morogoro as the collection station in Dakawa is no longer operating.

Figure 2 shows a 0.5 ºC rise (from 30 to 30.5ºC) in maximum temperature for Morogoro over the period from 1971-2010. Figure 3 shows a minimum temperature has also increased in this period from 18.2 to 19.7ºC.

Figure 4 shows a decrease in average annual rainfall from 900mm to 800mm between 1977-2007. The period between 2000-7 appears to show a greater fluctuation between years with 1200mm recorded in 2006 and 450mm in 2005.

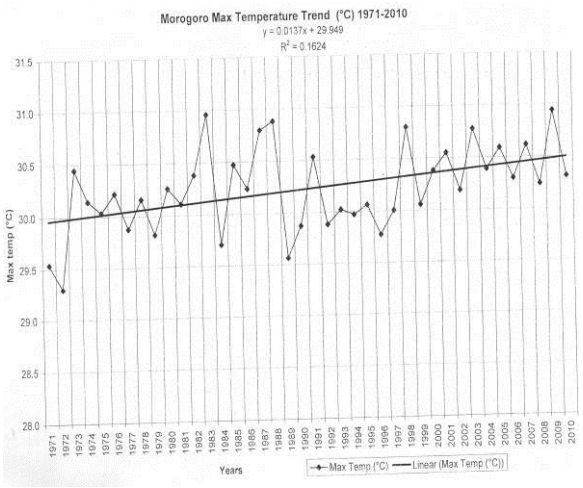

Figure 2

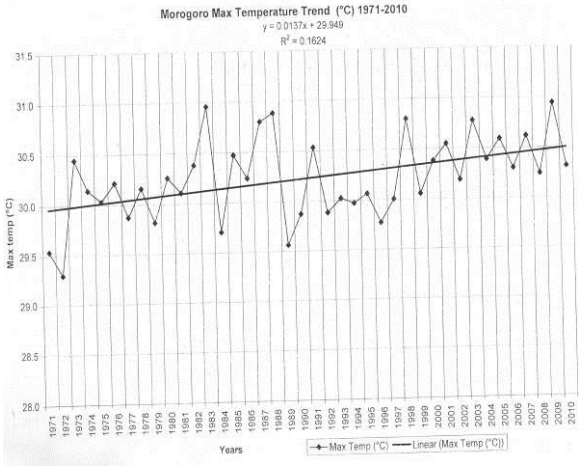

Figure 3

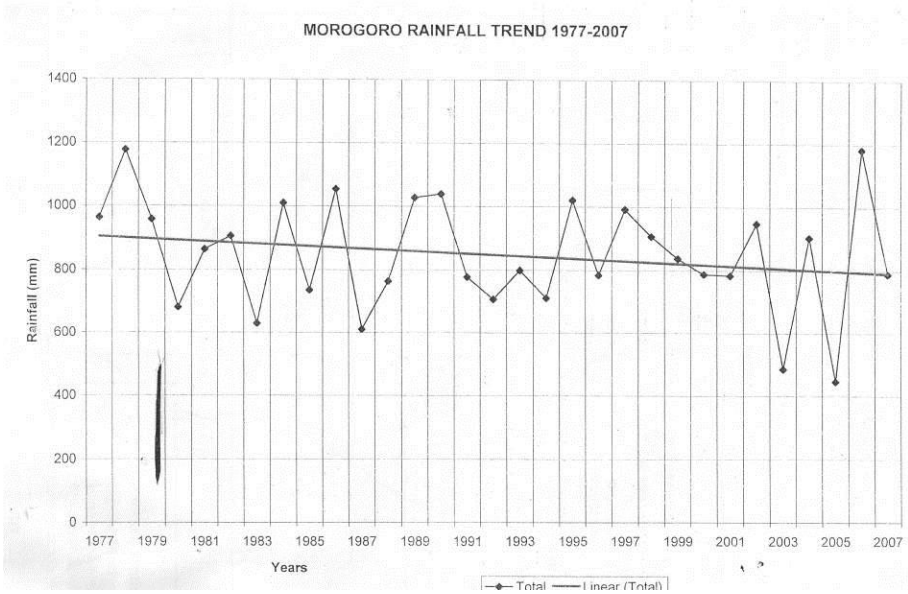

Figure 4

Figure 5- Annotated to show location of Dakawa from Paavola (2008)

The soil in the Dakawa area is alluvial and fertile (MRO 2006).

1.2 Livelihoods

Survey results and observations in Dakawa indicate that livelihoods are predominantly agricultural. 51% rely on agriculture only. The other 49% combine agriculture with other activities: 35% of all respondents operate a small business (such as shops and bars), 9%

are livestock keepers and 5% also have formal paid employment. The predominant crop is irrigated rice paddy with 78% of survey households doing this. On dry land, 47% of farmers produce maize and 16% rice with small numbers also producing tomatoes, leafy veg and other crops.

In our survey, 9% had no formal education, 63% were educated to secondary level, 16% had secondary education and 3% had tertiary education.

1.3 Population Dynamics

Dakawa is a relatively new settlement with an agricultural population centred on the irrigated 2000-hectare[1] rice farm. Our survey indicates that 77% had not lived in the area for all of their lives with the most common period of settlement being in the 2000s. Interview respondents confirm that the population fluctuates in relation to the labour demands of paddy production, and that all the ethnic groups of Tanzania can be found there. There are significant numbers of Masaai pastoralists in the area and tensions over access to land and damage to crops are common.

Dakawa is said to be Ward (kata) in the Tanzanian Local Government System but does not appear as such in the 2012 Census Report (URT 2013). Local government changes appear to have caused confusion and ward officials could not explain why Dakawa was not listed as a ward in the recent census. They thought perhaps it had been put into the Mvomero ward- this is listed as having a population of 37,321. Clearly Dakawa village only has a fraction of this population but the village office does not have accurate or current data.

1.4 Land Tenure and Land Use

Farmers in the Dakawa area tend to have a combination of land within the irrigated scheme and outside of it. Land outside of the scheme is used for rain-fed agriculture. Our survey calculated the average total land holding as 5.76 acres with 3.5 acres average of irrigated land and 2.2 acres of dry land. Irrigated land is predominantly within the control of the cooperative rice farm. Land within the rice farm is accessed by membership of the water users' association (UWAWAKUDA). Dry land is a roughly equal split of freehold and leasehold.

As noted above, the area does not have a long history of settlement for agricultural production and therefore customary ownership is not significant. However, disputes over competing usage between agriculturalists and pastoralists are common and have led to physical violence.

1.5 Irrigation & Agricultural Institutions

All farmers with irrigated land in this area are part of the 2000 hectares of the Dakawa Rice Farm. This farm is operated by Ushirika wa Wakulima Wadogo Wadogo Dakawa (translated as Society of Small Farmers in Dakawa), and known by the acronym UWAWAKUDA. To access land within the scheme an individual must obtain membership of UWAWAKUDA. UWAWAKUDA is working with USAID on a project to rehabilitate the pumping station which draws water from the Wami River. There may be some institutional confusion in relation to the legal classification of UWAWAKUDA. The Wami-Ruvu River

[1] In this report official documents and donors tend to state farm size in hectares. Farmers within the Dakawa Rice Scheme measure their plots in acres (1 hectare = 2.47 acres)

Basin Office views it as a formal and registered Water User's Association (interview with Hamis Maskini), however Harriet Obembo of ACDI/VOCA (USAID Contractor) suggests that UWAWAKUDA is a cooperative society and so is regulated by a different constitution and law. As a society UWAWAKUDA has a formal relationship with government, as a WUA it would be more akin to an NGO.

The Chollima Research Centre (CRC) is also located in Dakawa and uses 100 acres of land within the scheme. It produces seed for the national Agricultural Seed Agency (ASA). This centre is under the Ministry of Agriculture, Food and Cooperatives. The current Chairman of UWAWAKUDA is also an Agronomist in CRC. Agricultural Officers from CRC work do frequent extension work with local farmers on improving the productivity of rice production. CRC has a number of externally funded donor projects relating to rice productivity, such as an Australian-funded initiative on the 'System for Rice Intensification'.

Dakawa is also the location for the Demonstration Centre of China Agricultural Technology in Tanzania. Opened in 2009, the Centre has 62 hectares of land and is experimenting with the production of Chinese hybrid varieties of rice, maize, vegetables as well as intensive poultry production. This Centre draws water from a borehole, not from the Wami River. The Centre works in partnership with the Tanzanian staff of CRC and hosts frequent Farmer education sessions.
Otherwise, land registration, allocation and agricultural extension work comes under the Mvomero District Council and the Dakawa Ward Office.

The Wami-Ruvu River Basin Office (WRRBO) oversees the use of water from the Wami River and can issue water rights.

2. Irrigation Arrangements

2.1 Nature and organisation

Irrigated agricultural production in Dakawa is dominated by the Dakawa rice farm, now run by the cooperative water users' society, UWAWAKUDA, which is characterised as a co-operative society for small rice farmers. The maximum block of land that can be farmed by one person is 12 acres. The plots within the farm are divided into 12 acres blocks. Some 12 acres blocks are farmed by more than one family given capacity constraints in capital for investments (hence the average of 3.5 acres per farmer in our survey). However, it is reported that some families use several blocks of 12 acres by registering the blocks under the names of different family members. Verionica Urio mentions the names of other family member who own blocks (or who had them confiscated). There is a bigger charge made by her and repeated by Harriet Obembo of ACDI/VOCA that large blocks of land are owned by significant figures in government (such the Morogoro Regional Commissioner, Joel Bendera.

Current membership is given as 954 farmers. Harriet Obembo explains that her office (in their capacity as a large donor to the scheme) has been trying for some time to get access to lists of members but that such requests are resisted. She suggests that in reality many 'farmers' are simply 'labourers' on other people's land.

Veronica Urio asserts that there are many villagers living in Dakawa who would like to get access to land on the farm but are unable to given the political nature of land control.

Outside of the UWAWAKUDA scheme, a very small number of farmers use their own private arrangements to draw water from the Wami river (small pumps) or by borehole (1%)

2.2 Distribution of land under irrigation

The 2000 hectare rice farm in Dakawa is divided into plots of 12 acres.
Using satellite imagery the scale of the farm can be seen:
http://www.maplandia.com/tanzania/morogoro/morogoro/dakawa-6-26-0-s-37-32-0-e/

The settlement of Dakawa runs to the north from the Morogoro-Dodoma Road. The rice Farm sits to the right of the settlement alongside the Wami River. The water pumping station is at the southern tip of the farm.

2.3 Water sources and reliability

All the water for the Dakawa Rice Farm is taken by pumping station from the Wami River, which flows through Dakawa. A substantial cost (15 million Tsh (£6000) per month) is paid to TANESCO for electricity each month. A USAID-funded project is underway to rehabilitate and install new pumps in the pumping station to make this operation more efficient. Further discussion on the sustainability of this is found in later sections of the report.

A number of interviewees report that the flow of the Wami River restricts the operation of the scheme. In 2013 only one crop of rice has been cultivated as the level of the river is too low to run the pumps. This is attributed to competition from upstream users including large commercial investors who are also taking water from the Wami.

Although our survey results were not conclusive on this issue: 33% strongly agree that water availability has declined, 19% somewhat agree but another 29% disagree with the remainder saying they don't know if water availability has changed.

12% argued that climate change was the main factor for the change, 2% said drought, 8% said destruction of water sources, 7% deforestation and 13% shortage of rainfall. The remainder could not give a reason.

2.4 Key crop produced and productivity (income estimates and market linkages)

Rice is the only crop produced within the scheme. Several farmers report increases in productivity due to inputs from USAID (NAFAKA project under the 'Feed the Future' initiative), CRC and the efforts of farmers themselves. Farmers report the potential to get up to 45 bags (approx 50Kg) of rice per acre with current irrigation and techniques. However, a number also report that whereas in 2012 they were able to get 100,000Tsh (£40) per bag of rice, whereas in the 2013 season they have received only 50,000Tsh (£20). Therefore the increasing productivity has been offset by the decline in price. Veronica Urio in a an informal meeting revealed that many farmers had taken loans for their production costs and were now struggling to pay them back given the drop in price they were able to get for the rice.

According to the Chairman, George Iranga, all rice is sold at the farm gate with buyers coming to Dakawa. The Farm currently has no storage facilities, processing capacity or transport. He says that these are required to increase the profitability of the scheme.

Harriet Obembo casts further light on this situation explaining that the only milling machine owned by the scheme under TANRICE[2], but this was sold off to a private investor. She says that farmers were misadvised not to use the services of this private investor. She goes on to say that '*the small farmers are like babies. They just do what they are told.*'

Some farmers reported that rainfed land could produce greater profits on rice production (than the irrigated land) in a good year, as the land outside the scheme could be farmed with lower inputs and so had a lower production cost- a financial analysis of inputs and outputs is provided in Appendix 4. It is based on financial interviews with 10 farmers. This shows that in a good year then the costs of rainfed rice production are significantly lower therefore the farmer believes it is more profitable although it is not. The calculation for the farmer in the Dakawa scheme does not include the full cost of electricity and maintenance and so is effectively subsidised production. Analysis of the accounts for UWAWAKUDA suggests that farmers are not paying the full costs of production in the scheme and that large inputs of aid fill the shortfall. This will be further explored in a dissertation project by Chris Mdee.

[2] TANRICE was a project supported by JICA- see http://www.ippmedia.com/frontend/?l=45983

Many farmers reported that the good productivity in the scheme contributes to improvements in the family diet (through improved ability to purchase other food stuffs) and income.

However, one female farmer said:

"*The productivity has really done nothing to improve the family diet. My husband soon after harvesting, is the one who is responsible for the money, even when I ask how much money we have gained from the sale, he won't tell me rather he will be abusive and insulting to me and my family. I am just here to cook, work and reproduce the kids."*

2.5 Irrigation Technology & Evolution

The Dakawa Rice Farm was originally a state rice farm and was built in 1981 with aid from North Korea. The farm in this period was under NAFCO the National Agriculture and Food Corporation (Chachage & Mbunda 2009). NAFCO collapsed in 1996 and the farms under its control were sold or transferred to the Parastatal Sector Reform Commission (PSRC). Before this farmers with long residency in Dakawa report that NAFCO was bankrupt years earlier and the farm was unused for a period of 10 years.

After the intervention of PSRC, the farm was given to a number of high profile police or political figures ('the group of 6'), they invited other villagers to join them and an organisation called DAKCOP emerged in 1999 to take over the farm. At this time PSRC issued a letter to order the farm to be handed over to the villagers of Dakawa. The then District Commissioner (Kamote) order the farm to be divided between the Dakawa Village Council, Government Officers and DAKCOP. This led to the breakup of DAKCOP and UWAWAKUDA was established.

This period coincides with the increase in population with Dakawa.

The first Chairman was unelected after two years as members were not satisfied that some plots were inaccessible and did not receive water.

The second Chairman, elected in 2005/6 for two years was accused of giving plots to more than 1 person.

"At this point the Village Council decided that they wanted to take control of the farm and they installed Mzee Urio to become the Chairman." Farmer Matola

Mr Urio, whose wife, Veronica is featured heavily in recent donor project publicity on Dakawa (see appendix 4), is accused of corruption and mismanagement:

"Another conflict emerged because water availability become more scarce and people who paid their money to get the plot didn't get any. There was a lot of conflict about money as it seems the money was not deposited in the bank. Therefore some people took the matter to the Ministry of Agriculture and they conducted an investigation". Farmer Matola

Following an investigation, Mr Urio was removed and the current leadership (Chairman: George Iranga) with other Ministry appointees as Deputy Chair, Bursar, Farm Manager and Pump Attendant were installed for a period of 3 years to get the farm back on track.

"Since they took over there hasn't been a problem, money is available and the productivity has increased from 15-19 bags per acre to 30-35 bags." Farmer Matola

It may be significant that this period coincides with external intervention by USAID under the 'Feed the Future' Programme with has significant inputs for increasing farmer productivity. Work on clearing irrigation channels and a feasibility study for the replacement of the existing pumps has also been undertaken.
Informal comments from project engineers suggest that the replacement of the pumps may not happen as the level of the Wami River will not sustain the cost effective operation of the pumps.
Harriet Obemba also says that the Engineering company, CDM Smith, have been in Dakawa for 3 years but have not been able to make progress on the project as the process for tendering for replacement pumps has been politicised.

Veronica Urio asserts that the removal of her husband as Chairman was purely political- as he is a Chadema (opposition party) supporter, whereas the current Chairman, George Iranga is a CCM secretary. Her assertion is that the real small farmers of Dakawa (herself included) are marginalised by less visible but more powerful political interests:

'If the Regional Commissioner wants his plots water then all he needs to do is to call the office here and it will happen, even if it is not in the planned watering cycle.'

She also suggests that a plot belonging to her daughter was taken and given to the current Village Council Chairman and Village Executive Officer.

2.6 Rules in practice-equity, compliance and punishment

Rules within the UWAWAKUDA scheme for water usage are highly formalised and will be dealt with in the next section. Water access from the river outside of the scheme is in theory regulation by the Wami-Ruvu River Basin Authority. Although an anonymous official at the Morogoro Head Office said he didn't need to be interviewed as his job was very simple:

"We are just here to sell the water".

The local Wami-Ruvu River Basin Ward Officer explained that at the local level he is only responsible for registering new groups of Water Users and informing them of the regulations that are in place under the 2009 Water Users' Act. He is also responsible for enforcing this act but said that no one has yet been prosecuted under it.

" Water usage has increased due to irrigation. Long ago people did not know how to irrigate. We are trying to control this by giving permits and educating those who are water thieving. The rive level has gone down due to the lack of rains and not due to the number of users".

In practice, interviews suggest that regulation of water use is not effective and has led to upstream users drawing too much water which has led to the reduction in the flow of the Wami.

Director of WRRBO (Praxaeda Kalgeundo) confirms that in the Dakawa area, work on registering WUAs is well advanced and they are functioning to issue permits. She admits that her office has no capacity to regulate or control the quantity of water that users take once their permit has been issued. She did admit there was an upstream water use issue with the Wami River, where it is believed that the river has been diverted for irrigation use

but that there is no return flow. Retired Dakawa Farmer, Chris Nikitas, also makes this suggestion.
John Rassambili mentions other large water users on the Wami as Mtibwa Sugar and EcoEnergy – producing sugar and renewable energy.

Some interviewees (such as technical staff from Chollima Research Institute) suggest that in order to the Dakawa Rice Farm to be sustainable, much stronger regulation, compliance and punishment would be required.

2.7 How have rules and practice evolved?

National policy in theory issues water rights to different users through the River Basin Authorities. The Rice Farm is an official water user but there are no other official water users of the Wami within Dakawa Village. However the local River Basin Officer reports that he deals with more than 20 upstream groups.

As noted above- the ownership and rules and practice within the rice farm have evolved in relation to different periods within the history of the scheme. This will be dealt with in more detail below.

2.8 Mechanisms for determining water availability

Water availability within the rice farm is determined by the Board and Farm Manager. However, interviews indicate that there are instances of bribery whereby some people may have been able to access water ahead of others. Irrigation water is pumped according to a cycle agreed by the Farm Manager and the Board. The plots of land nearest to the pumping station are the first to receive water. Those plots farthest away from the pumping station do not receive water until several weeks after the first plots and therefore the timing of tasks and production varies according to the position of the plot within the scheme.

Overall availability of water in the Wami River is in theory managed by the Wami-Ruvu Water Basin Office. A number of interviewees expressed a need for far greater rules and regulations in relation to rights to water access upstream, given the current problems with the level of the Wami.

WRRBBO admitted that her office did not have the capacity to regulate and control water availability. So the current situation is that water user groups are constituted according the to the 2009 Act, they are issued with permits to draw water of a certain amount. The amount taken and the efficiency of use is not regulated and Praxeda Kalageundo, Harriet Obembo and John Rassambili amongst others state that efficiency of use is a crucial factor. Much irrigation practice (including the Dakawa Farm) is highly wasteful and inefficient.

3 Irrigation Water Management Structures

3.1 How are formal institutions constituted?

All farmers using the scheme are members of the UWAWAKUDA and can apply to become members of the Board which oversees the operation of the irrigation scheme. All members are entitled to attend the General Meeting, where the Board Members, Chair and Secretary are selected by a vote. The Chair and Secretary are salaried positions (accounts show salary levels to be quite high and also show additional allowances). To access land in the scheme you must be a member, having paid a membership fee (referred to as HISA). There is currently a waiting list for membership. To become a member you need to have 10 shares (HISA) and these are 10,000Tsh (£4) each. The share does not generate a dividend.

The current Chairman of the Board is also an Agronomist (Mr George Iranga) at the nearby Chollima Research Centre. The Board also employs a professional Farm Manager to supervise the pumping operations. Members of UWAWAKUDA pay 60,000Tsh (£24) per acre per year to cover the cost of electricity to operate the pumping station. Water is drawn from the Wami River by a pumping station and it is the Board who make decisions on when water will be pumped, and the cycle by which it reaches the different blocks. This charge does not cover the costs of electricity or the maintenance of irrigation channels.

The Management are responsible for the maintenance of the main canals and the pumping of the water- in theory these covered by the fees paid by members but accounts show a shortfall.

Within the 12 acres plots, then the users of these plots are responsible for the maintenance of channels and water flows. Where multiple farmers share a block they elect a leader and must co-operate with one another on deciding when water is allowed into the plots.

3.2 How do they relate to other local institutions?

UWAWAKUDA is stated by some interviewees to be an independent organisation, but the history shows influence by the Dakawa Village Council and also from the Ministry of Agriculture, Food Security and Co-operatives, the latter who currently constitute the Management Team for the farm. Further analysis of interviews suggests that UWAWAKUDA is a co-operative society and so has a formal link to government, rather than being a fully independent organisation. Verionica Urio, Harrient Obembo, Andrew Tarimo and others underline the high level of government (CCM?) involvement through plot ownership.

Extension inputs through JICA, USAID, CRC and the Chinese Centre are mentioned as significant but these do not interfere with the operation of UWAWAKUDA.

3.3 What are the arrangements for assessing water availability, water management and allocation?

Irrigation water is pumped according to a cycle agreed by the Farm Manager and the Board. Given the problems with the level of the Wami River, in the 2013 season, water was pumped to the farms from April-July. The plots of land nearest to the pumping station are the first to receive water. Those plots farthest away from the pumping station do not receive water until several weeks after the first plots and therefore the timing of tasks and production varies according to the position of the plot within the scheme. There are four sections to the farm and gates across the irrigation canals are open and shut to control the flow of the water.

It was reported that the timing of the flow can disadvantage those farmers with plots at the furthest corner as by the time they receive the water, the weather is already becoming colder (June/July). Farmers interviewed see this as unfair and note cases where some with the plots furthest away have failed to produce a crop.

Joseph John, a Researcher at CRC argued that it was only fair that the CRC plot of 100 acres received water first as they are conducting experiments, doing extension work and producing seed for the Agricultural Seed Agency.

Farmers within each 12 acre block need to decide collective when they will open the gates to water the plot. They can make this decision when the water is flowing to their section of the farm. Anyone who is found to be stealing water can be expelled from UWAWAKUDA and there are one or two examples of farmers being expelled as a result of physical conflict over water stealing during the night.

Farmers uniformly say that fairness is important as a principle and on the whole agree that the formal system tries to be fair.

3.4 What are the limitations of these arrangements?

Most farmers interviewed report that the current arrangements are working well. Given the turbulent political history of the farm, it was said by a number of interviewees that in the past pressure might be brought to bear on the Farm Managers to divert water to plots belonging to powerful individuals.

"A big shot might call up the Farm Manager from Dar and tell him to send the water to his plot" George Iranga- Current Chairman

It is said that this can situation can no longer happen. Farmers in the interviews consistently express a high level of trust and confidence in the current management.

However, the influential Veronica Urio is highly critical claiming that the big political players can still control when their plots will receive water.

The main reported limitation of this system is where a number of Farmers share a 12-acre plot and they may be at different stages of cultivation or may use different methods of rice production (broadcasting vs transplanting) and so they may require water at different stages. Some Farmers may also be more organised than others.

Farmers within the blocks must have a high degree of cooperation. A number of Farmers reported that there is an issue with this.
Some said that they had worked with their co-plot holders for a number of years and so they had a high level of co-operation and trust. They could meet together and agree when they need to allow the water into the plot

"We have worked with each other for some time and so we know how to co-operate!- Paul John

However, most Farmers also cited this arrangement as being the reason for conflicts and disagreements.

Levels of trust between plot holders clearly varies as the shown in the quotation below:

Christina Kesuke:
"We don't trust each other because everyone is looking after their own interest. Although we might be talking and sometimes do things like ploughing and harvesting together, deep down no one trusts anyone."

There is also some jealousy that certain individuals appear to be given preferential access to loans and study tours.

Some people also argue that the tight schedule for pumping water is too rigid and has no flexibility.

Others also argued that the flat rate of 60,000Tsh per acre is not fair as those who only have 1 acre are likely to be much poorer than those with 12 acres. It is accepted by Management that there are members who may have insufficient capital to pay the fees and they may be forced to rent out their plots to others.

Veronica Urio reports that*: "there are rumours that next season each farmer will pay almost double per acre as compared to last season. It is expected to exceed 100,000Tsh per acre. This will be a disaster to most of us. If we don't pay the expected amount then we will be considered ineligible and our land will be granted to other people- for that land access for us small farmers is not guaranteed."*

Financial analysis in addition to interviews with Alex Ghaui (Opportunity Tanzania) and Veronica Urio suggest high levels of borrowing by farmers to fund production. Further analysis is need to investigate if an increase in water payment will impact heavily in the viability of production. Veronica Urio admitted severe issues with receiving payment for her rice in 2013 leading to repayment and credit problems with borrowing. She was not looking to move into irrigated vegetable production as an independent farmer.
" I have thought about going to visit the US Ambassador to ask for his help"

The biggest limitation for the whole scheme is the insufficient level of the Wami River- if levels were adequate then at least two crops per year could be produced- this is the base line assumption of donors looking at the rehabilitation of the scheme. Without this, several engineers have expressed concern that the scheme is not viable.

The high cost of electricity to operate the pumps is also a significant issue for the scheme and a limitation in terms of cost effective production.

3.5 What is the nature of conflict over water and land?

There is no open conflict over the allocation of land but there are allegations of issues around membership of UWAWAKUDA which itself confers access to land. It is alleged that some people have been allocated plots without having to move up the waiting list. Further that some families have gained access to multiple plots by registering them to a series of their relatives.

As reported by Veronica Urio and others there is also the issue of high level political ownership of multiple plots as mentioned in several sections above.

More instances of conflict relate to the water sharing arrangements in the 12 acre blocks. farmer interviews suggested that such conflicts are common and where they cannot be resolved are brought to the Farm Manager and Chairman for adjudication. Examples were cited in the 2013 season of 2 members who were expelled for stealing water from others at night. One interviewee, attested that physical conflict had erupted on occasion and that there had once been a fatality as a result.

Another interviewee says that water theft is common:

"There is also water thieving, which is very problematic. It gives me as a leader of a block a moral dilemma as to whether to report them, as it warrants the cancellation of their membership. These are people we know therefore we tend to let them off which can only encourage such behaviour". Paul Edward.

One young Farmer also alleges bribery:

"People are very corrupt, some people give as much as 50,000Tsh (£20) to irrigators so that their plots get water but you can give as little as a loaf of bread. The Management never come to inspect if the plots were watered or not and therefore this gives the opportunity for corruption to continue". Joseph Rimesi

Veronica Urio also expresses a frustration that the farm is not for the people of Dakawa:

"For your information, there are many villagers "Dakawa dwellers" who are in need of land in the scheme but don't have access to it, therefore the issue of land accessibility is becoming complex as time goes on".

3.6 Assessment of efficiency and effectiveness

Farmer interviews suggest that within the scheme there is a general satisfaction with the efficiency and effectiveness of their own production. They were able to articulate significant recent gains in productivity through access to better seed, fertilisers and improved cultivation techniques through USAID/NAFAKA. They also express that water sharing within some limitations is as fair as it can be given the current limitations in pumping operations.

Harriet Obembo of the NAFAKA project confirms a significant amount of work has been done at the scheme on improving productivity of production, for example on transplanting

and the use of manure and other inputs. Access to credit has also improved farmers ability to purchase inputs. On the other hand she is critical of farmers being vulnerable to being sold unsafe chemicals. She mentions Chinese sales people who sold a contaminated pesticide to one farmer who then lost his whole crop as a result.

There is a bigger question of efficiency and effectiveness.
Our interview with George Iranga articulated an impressive vision for expansion of the scheme, for the concreting of irrigation channels to improve water retention and efficiency, the construction of on-site storage and processing facilities and the purchase of transport that would enable farmers to sell rice at a much higher price. However, with the current level of farmer contributions, it is unlikely that UWAWAKUDA can raise the capital for this type of development without further donor intervention.

It would appear that the scheme is not sustainable from internal resources.

Engineers working on the re-fit of the pumping station funded by USAID express doubt that the re-fit should even continue given the decline in the level of the Wami River. The decline is attributed by some to upstream useage (Managers of Dakawa Rice Farm/CRC staff) and by retired Dakawa Farmer, Chris Nikitas as the destruction and degradation of the Mountain Forests that feed the Wami.

There are differences of opinion in relation to the issue of 'smallness' and efficiency. The registration of several plots to the same families (using relatives names) is seen by some as subverting the ethos of 'smallness' and preventing poorer farmers from accessing the scheme. However, one Engineer with experience of Dakawa over several decades argues that at least those with large acreages can afford to invest in the irrigation infrastructure-such as concreting channels. Large owners (such as the Urio family) in this view are successful entrepreneurs. Veronica Urio also still clearly sees herself as small farmer in opposition to the very large political farmers she mentions as present in Dakawa.

3.7 Relationship to National Policy and Regulation

National Policy on irrigation is fairly vague but has emphasised increased investment in schemes of the nature of Dakawa. The water users' arrangement used by UWAWAKUDA is in line with national policy on water rights, which seeks to decentralise water to the user. Many interviewees looked to external agencies for support and argued that it was government that was failing to invest in agricultural development.

Dakawa is significant in relation to the national context as it is exactly the type of agricultural modernisation project aimed at small farmers that is articulated in the ten pillars of the kilimo kwanza policy.

As mentioned above the Dakawa Rice Farm is also a site of aid intervention from the current USAID reawakening in African agriculture, and therefore also politically significant in the national aid landscape.

4. Irrigation, institutional and local area development

4.1 Identify the impacts of irrigation at the local level (±)

For those who can access land within the Dakawa Rice Farm and have sufficient capital, knowledge and inputs to farm it then production can be excellent. People can improve their livelihoods and use the capital to educate their children and create other enterprises.

However, in the key informant interviews and mentioned by some farmers was a broader problem that some people did not know how to use the income they gained. Some Farmers were accused of drinking their profits and failing to invest in inputs for the following year. John Joseph went as far as to argue that he believed a special research project was required to look at this 'cultural problem'.

Potential gains from irrigation are not being maximised as the scheme is not able to run at capacity given the water shortage. In addition, the low price offered for rice in the 2013 year erodes the positive impacts of irrigation.

As Veronica Urio suggests given recent problems with payments for rice, credit and potential increase in water charge she is looking at alternative enterprises. However, she does confirm that the productivity of her land had increased around three times in recent years due to the adoption of new methods.

4.2 Factors shaping uptake of farming technologies, access to knowledge and learning processes

Farmers within the Dakawa Rice Farm have benefitted in the last 3 seasons from the inputs of the USAID NAFAKA project and from the other projects delivered through the CRC. There has been a move to using the SARO5 hybrid rice variety and to transplanting rather than broadcasting rice seed.

John Joseph spoke about the need to conduct participatory research with Farmers, and to conduct experiments with them.

"People learn from seeing things, for example at the NaneNane Agricultural Shows. Participatory research works best, for example with conservation agriculture. We do the research on the plots with Farmers and we ask them to make comparisons and we encourage them to choose which is plot is best"

Factors shaping the uptake of technology are said to be accessibility of things such as study tours to inspire farmers, the activities of lead farmers but also sufficient capital to invest in the inputs that might be required. Some techniques may also be quite labour intensive- for example John Joseph says that some farmers are not ready for the *'drudgery'* of transplanting rice seedlings.

He also said that some farmers were more ready to learn than others but you had to start worth what farmers already know –*sometimes farmers may not know the reason they are doing something, if they have always done it, but then we come to explain why it might be a good idea or not. The trouble is that the old practices can quickly exhaust the land.*

Given the relatively recent settlement of the area and the influx of farmers in the 2000s there is little evidence of particularly dominant 'traditional' practices. Some farmers came from other rice growing areas and did learn from their parents, but others were new to rice production and to have learnt from their neighbours and extension workers.

Sometimes differences in speed of technology uptake in the plots can also cause tensions in relation to the timing of when water is required.

It is also difficult to generalise in relation to learning given the ambiguity around the nature of 'smallness' within the scheme. There are very many small farmers but there are also large scale farmers using the UWAWAKUDA system- these farmers have significant differences in the availability of capital to invest.

Our survey suggested that 67% used conservation tillage, 30% were doing legume incorporation (probably not with irrigated rice but with dryland crops) 29% were water harvesting, 10% were doing crop rotation, 21% using manure/compost and 2% infiltration pits.

The most common way of learning in the survey was from neighbours (65%), followed by from NGOs (30%). Interviewees all characterised USAID, JICA and the Chinese as NGOs. 16% mentioned extension workers and 4% Lead Farmers.
61% said these practices had a positive effect.

This is confirmed by long interviews in which farmers also agree that recent demonstrations, study visits and activities by the CRC and NAFAKA staff have led to significant improvements in productivity. George Iranga cites this as the major achievement of the scheme in the most recent period. Harrient Obembo describes the NAFAKA approach as one of working with lead farmers who then cascade knowledge.

40% of Farmers are providing casual labour to others in the area and 87% of these said that they had learnt new farming practices through this method.

In the survey 30% of farmers said they used advice they had received through the radio and another 30% said they used advice via mobile phone. It is hard to say if the information received encouraged them to start a new practice or confirmed practices that they had already learnt from other sources.

In discussions on what makes a good farmers, respondents universally saw this as someone who was prepared to listen to advice, to try new things but also had the capital to invest in inputs and machinery.

4.3 Livelihood sensitivity to water stress and strategies developed for coping and adapting.

In the research we have focussed on the irrigated land rather than dryland production. In good years (heavy rains) some farmers suggested that the dryland is better for productivity and cost of production (especially if you don't have investment capital). However, having irrigated land meant you are assured of getting a crop if you have done the work and have capital to buy inputs. Financial analysis show the profitability of irrigated land is actually

greater, and farmers may perceive it as more profitable given the much lower production costs. It is this margin of profitability that may be lost if the cost of water increases.

Whilst some external interviewees expressed doubt that the scheme was cost effective given that it is not running at full capacity- the farmers seem to be satisfied that they can guarantee at least one good crop per year.

They have always lived with uncertainty on the dryland- rainfall has always fluctuated. So on dryland they plant a range of crops to spread the risk.

Within the scheme the internal issues of water allocation need to be adapted to by close cooperation with neighbours who share plots to ensure water is used at the right times. Engineers argue that more investment in cleaning and concreting the canals in the scheme could vastly improve the efficiency of water usage.

4.5 Role and impact of external partners (government and NGOs) in agricultural research, learning and innovation (politics of knowledge)

External partners have played a significant role alongside the political and business entrepreneurs in reviving the ailing NAFCO farm. The farm would not be operational without a significant aid subsidy from USAID (and before them JICA through TANRICE). The current aid fashions around agriculture and the location of Dakawa (a day trip from Dar-es-Salaam) makes it an ideal 'photo op' for the aid circus (see appendix).

As retired Dakawa Farmer, Chris Nikitas, likes to say:
All the world is coming to Dakawa....even the Queen of Denmark has been there'

Veronica Urio mentions the Danish money as having been absorbed into the project and not benefiting small farmers.

There was rumour that Barack Obama would also visit on his recent trip to Tanzania but this did not happen (however the US ambassador has been)

The farmers of Dakawa variably cannot and/or prefer not to use their own money on maintenance and rehabilitation of the irrigation technology. Their own contributions barely fund the cost of the electricity to run the pumps. George Iranga talks about the need to attract new donors to fund the construction of storage and milling facilities.
The USAID NAFAKA project has facilitated study tours, access to grants, loans etc, all of which have changed the way farmers are cultivating.
Fertiliser and Chemical companies also play a role and farmers may be able to purchase inputs on credit.

The Chinese are also present in Dakawa through their 62 hectare agricultural research and learning facility. Professor Chen (with 120 powerpoint slides and a glossy brochure) reports that Chinese hybrid varieties of rice have huge production potential outstripping the best locally available hybrids (such as Saro 5). They run residential courses for 300 farmers per year since they began operation in 2010.

We asked Professor Chen why the Chinese chose Dakawa- he replied that the Government of Tanzania had told them to come there.]

"They told us to come and they promised us that we would have our own line from the Wami River, but that has never happened. So we had to dig our own boreholes and we are only using a small part of our land as there is not enough water.
The trouble is that ***you people*** *(indicating Chris and Bahati) want something for nothing. You cannot get anything good from the land unless you will put water there and do agriculture properly. I have seen several Ministers of Agriculture here and also I have told the President. They all promise that the water will be brought here but nothing has ever happened. I am not interested where they get the water from".*

4 years of isolation in Dakawa and frustration with the government had clearly annoyed Professor Chen.

Government appears to be present only for photo opportunities- glossy pictures of Kikwete shaking hands with the Chinese Ambassador adorn the walls in the Chinese Centre.

An interesting angle here could be on the construction of the 'smallness' narrative by external government, key players and UWAWAKUDA and donors themselves- see appendix on case study of Veronica Urio. Does Veronica Urio need a $2000 grant for farm implements and how much land does she really have? Veronica Urio sees herself clearly as a small farmer with the big farmers portrayed as the political and civil service elite.

4.8 Flexibility/rigidity in rules for managing irrigation and implications for institutional adaptability to changing water availability

UWAWAKUDA has managed changing water availability through the collective decision making body and their General Meeting- they have technical constraints caused by the flow of the river which means the scheme is running at less than full capacity.
Localised flexibility in application of the rules on water use is seen by Farmers who share the 12 acre plots- they must cooperate and trust one another.....however this leads to the most frequent reason for conflict.

Long-term if the water gets scarcer and the pumps are not even able to sustain one season there may be greater pressure on the rules for managing the scheme.

Verionica Urio claims to have heard a rumour that some pumps have been stolen and that production is in doubt for the coming season.

Outside of the scheme there are rules and regulations on water use set by WRRBO registering water users and issuing permits (formal rules on usage which are there are not enforced) and this depends on capacity to drill a borehole or having land with river access.

4.9 Indicators used for monitoring and evaluating progress in irrigation projects

Increases in productivity and income are seen by interviewees as key factors in M&E for irrigation.

Some expressed the need to assess water availability and efficiency of use but were not sure how this could be done e.g. Joseph John of CRC. This was seen as the responsibility of the government. This is in fact the responsibility of WRRBO but the Director reports that her office has no capacity and that she is looking for a 'donor'.

4.10 Access to land as a determinant of access to water, and issues surrounding economic access to water for irrigation

Access to land within the UWAWAKUDA scheme is a determinant of access to the pumped water of the scheme and as noted above any farmers who want to join the scheme needs to have capital to pay the HISA and also to pay the pumping cost as well as the inputs of seed, labour and fertilisers/chemicals required to bring a crop to production.

In relation to the wider issue of access to land and water in the Wami River catchment- the big landholders in the surrounding area are big political/business figures- Mwinyi, Raila Odinga (Kenya), Jeetu Patel and Kikwete amongst others (source Chris Nikitas). This is also noted in the HakiArdhi 2009 Report on the fate of the NAFCO and NARCO farms and ranches. These lands are part of the Dakawa Ranch (Chachage & Mbunda 2009)

4.11 The role of trust within institutions and its implications for knowledge use and growth in the small-scale farming systems

Trust is clearly an issue within UWAWAKUDA- the history of the scheme shows a succession of problems relating to a lack of trust in the leaders and managers of the rice farm.

Those who are genuinely small farmers (sharing the 12 acre blocks) must trust each other in order to collectively manage the inputs of water. Interviews clearly show that breakdowns in trust caused by differences in farming approach and water theft cause conflicts and a breakdown of trust. There is a tension within the blocks as to whether to resolve these conflicts internally as a group or to take their cases to the Managers.

A number of interviewees say they do trust their fellow farmers- they have worked alongside each other for some years. However, some suggest that this is only surface deep as the interview with Christina Kesuke suggests above.

All interviewed Farmers say they do trust the current leadership but on probing a little deeper examples of a lack of trust emerged at the farm level where those in control of the irrigation gates could be bribed.

There is an interesting dynamic that the current leadership are essentially government appointees- Iranga is also a government employee. In a sense the farm is being managed by the state (it is an important and highly visible donor project and it needs to succeed). All interviewed employees of UWAWAKUDA and of CRC also have their own rice farms within the scheme and so they have a strong incentive to ensure that the scheme is operating well.

There is widespread trust in the ‘NGOs’- USAID funded projects for example- they are visible and active.

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Appendix 1 Formal-semi structured Key Informant Interviews

Name	Institution/title	Dates
George M. Iranga Agronomist	Chollima Research Centre/Chairman UWAWAKUDA	31/5/2013- Dakawa
Prof Chen Hualin	Demonstration Centre of China Agricultural Technology in Tanzania	17/09/2013- Dakawa Brochure obtained November 2013
Joseph John	Agricultural Research Officer- Chollima Research Centre	17/09/2013/
Mnyika Yuda	Farmer-Dakawa	19/09/2013
Mulokozi	Farmer-Dakawa	19/09/2013
	Ward Executive Officer-Dakawa	20/09/2013
Charles Haule	Farmer-Dakawa	20/09/2013
Wilson Mashauri	Farmer-Dakawa	20/09/2013
Ayubu Ajajili Mwalukula	Farmer-Dakawa	20/09/2013
Benson Mangula	Farmer-Dakawa	19/09/2013
Christina Kesuke	Farmer-Dakawa	19/09/2013
Matola	Farmer-Dakawa	21/09/2013
Paul Edward	Farmer/Businessman	21/09/2013
Nasha Ritalilu	Agricultural Field Officer-horticulture	22/09/2013
Mwanahamisi/Mama Mshale	Farmers	22/09/2013
Joseph Ramess and Mama	Farmers	21/09/2013
Hamisi Maskini	Wami-Ruvu River Basin Authority Ward Office Secretary of Water Distribution Committee	8/10/2013 7/11/2013
Veronica Urio	Farmer	Ricky's Cafe- Jan 2014 With Bahati- 14/11/2013
Chris Hall	Engineer- CDM Smith (contractors to USAID)	Informal discussions
Simon Golds	Engineer – CDM Smith (contractors to USAID)	Informal discussions
John Rassambili	Wami-Ruvu River Basin Board-Officer	4/11/2013
Praxeda Kalageundo	Director- Wami-Ruvu River Basin Office	15/11/2013
Alex Ghaui	Opportunity Tanzania	25/11/2013- Chris Mdee
Chris Nkitias	Retired Dakawa Farmer	13/11/2013
Harriet Obembo	Deputy Chief of Party-ACDI/VOCA – USAID funded NAFAKA project	13/11/2013
	Mvomero District Irrigation Officer	

Focused Group Discussions

18/09/2013- Farmers- Baraka Mwakasasa, Said Mohammed Alimas, Boniface Nzali (conducted by Elias Bahati)

22/09/2013- Farm Manager- Saidi Mazola, Cashier- John Kimambi, Charles Nyemele- Pump Operator (All three also farm within the scheme and are members of UWAWAKUDA

Survey Overview- n=115

Question	Percentage
Gender of the Respondents	40-Female 60-Male
Household position of Respondent	51- Household Head 44- Spouse 4- Children 1- Other
Gender of household head	13- Female 87-Male
Age of household head	Average- 40.5 Range 22-82
Highest level of educational attainment	8- None 63-Primary 16-Secondary 3-Tertiary
How many people in the household	Av- 2.7 Adults Av-1.5 Children (range from 1-8 in total household)
How many adults are working?	Av-2.17 per household
Have you always lived in this village?	23-Yes 77-No
If not, when do you come here?	Mostly arrived during 2000s (1 in 1980s, several in 1990s) Range from 1966-2012
What types of food do you consume?	100- Rice/Ugali- no change in consumption over the year
What other economic activities contribute to your household?	49- have other economic activities 35- Business/trade 9-Livestock keeping 5-Employment
How much land do you use?	Av- 5.76 acres (range 1-26 acres) Av- 2.2 acres dry land Av-3.5 acres irrigated land
What is the nature of the landholding?	Irrigated land- all members of rice farm Dry land- 26 leasehold, 17 freehold, 0.5 sharecropping
What fertiliser do you use?	17- chemicals in dry land 1-manure in dry land 4- mixed in dry land 78- None in dry land 59-chemicals in wetland 2-manure in wetland 13- mix in wetland 25- None in wetland

What crops do you grow?	16 rice in dry land 47 maize in dry land 2 beans in dry land 2 leafy veg in dry land 1 tomatoes in dry land 9 others in dry land 1 beans in wetland 2 maize in wetland 78 rice in wetland 3 leafy veg in wetland 3 tomatoes in wetland 3 others in wetland
If you grow maize- what varieties do you grow on which land?	46- do not grow maize 37- use hybrid maize 12- local 4- Mixed
Are there any crops that you started growing in the last five years?	Yes- 18 No- 82
Do you irrigate some of your crops?	Yes- 96 No-4
What is the source of the irrigation water?	River- 98 Dam- 1 Other- 1
Has water availability changed?	Strongly Agree- 33 Somewhat- 19 Disagree-29
What do you think is the cause?	12 climate change 2 Drought 8-destruction of water sources 7- deforestation 13- shortage of rainfall
Farming Practice- incidence	Conservation tillage-67 Legume incorporation-30 Water Harvesting-29 Crop Rotation-10 Use of compost/Manure-21 Infiltration Pits-2
Where did you learn this from? Did it have a positive effect?	65 learnt from neighbours 4 from Lead Farmer 16 Extension workers 30 NGO 61- strongly agreed 30-somewhat agree 2 disagree

	0 strongly disagree
Have you used advice through	Radio-30 Television- 3 SMS- 31
Do you own any of these devices	Radio-93 Television- 24 Mobile Phone- 91
Did you use the seasonal forecast in the last farming season?	Yes-38 No-62
If yes-	Local/traditional-10 Metereological-17 Both-8
Does your household provide agricultural casual labour within or beyond this village?	Yes-40 No-60
Are there any farming practices that you have learned through providing casual labour?	87% of those who provided casual labour learnt new farming practices

Case Study- playing the small farmer card....

Mrs Veronica Urio, "Mama Veronica"- the first lady of Rice in Dakawa

According to informal interviews with people connected to the Dakawa Rice project in the 90s and the current time, Veronica Urio and her husband have always been powerful local players. Mr Urio was a previous Chairman of UWAWAKUDA but in a group of officials removed from office for alleged corruption.

US Embassy Press Release- June 2012
http://tanzania.usembassy.gov/pr_6152013.html

All Africa – June 2012

http://allafrica.com/stories/201206160609.html

September 2012- US Ambassador Visit

http://reliefweb.int/report/united-republic-tanzania/us-ambassador-tanzania-inspired-feed-future-activities

Press Release- Mar 2013

http://www.acdivoca.org/site/ID/news-congressman-garamendi-visits-feed-the-future-project-in-tanzania/

The NGO
http://dakawamakolehope.org/about_founder.html

*"She is a stunning looking woman- her picture hangs on the wall of the US Embassy in Dar. The current committee hate her but she takes over everything when visitors come. She has brilliant English and so they can't understand what she is saying. She can turn on the tears whilst she praises the visitors for coming to save the farmers of Tanzania"...*Anonymous Aid Worker

"There are no small farmers in Dakawa"- Prof Andrew Tarimo

Photographs of Dakawa Rice Farm blocks and irrigation channels (post harvest dry season- October 2013)

Woman gleaning post harvest in 12 acre block

12 acre block

Over grown irrigation canal (on going debate about how farmers care for these)

Main irrigation canal

	Farida Zaharani		Chetu Kolongo		Mwajabu Haji		Fanuel Mbaji		Simon Sunza		Mbaruku Salum	
	Irrigated land 3 acres	Rain fed land 3 acres	Irrigated land 4 acres	Rain fed land 1 acres	Irrigated land 3 acres	Rain fed land 1 acres	Irrigated land 2 acres	Rain fed land 2 acres	Irrigated land 1 acres	Rain fed land 3 acres	Irrigated land 10 acres	Rain fed land 10 acres
Land rent		20,000		30,000		30,000		40,000		40,000		
Corporative development fee	5,000		5,000		5,000		5,000		5,000		5,000	
Village development fee	2,000		2,000		2,000		2,000		2,000		2,000	
Water	60,000		60,000		60,000		60,000		60,000		60,000	
Ploughing	40,000	40,000	40,000	45,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Preparing Furrows/Ridges	30,000		30,000		30,000		30,000		30,000		30,000	
Harrowing 1	30,000	30,000		25,000	25,000	20,000		20,000		30,000	30,000	30,000
Levelling			45,000				80,000		50,000			
Seedbed / Nursery Prep.			5,000		3,000		5,000		30,000			
Seed 16Kg	33,000	25,000	90,000	40,000	33,000	25,000	30,000	20,000	30,000	30,000	60,000	45,000
Harrowing 2	30,000			25,000							30,000	
Seed broadcasting	15,000	10,000		5,000		10,000		20,000		5,000	10,000	10,000
Transplanting			100,000		80,000		80,000		80,000			
Fertilizer 1 + labour DAP (50kg)	76,000		74,000		74,000		160,000		61,000		135,000	
Herbicide + labour (24D) 1lt									21,000	21,000	23,000	23,000
Weeding 1	60,000	60,000	11,000	70,000	20,000	10,000	10,000	40,000	40,000	50,000	80,000	70,000
Insecticide (1lt)												
Fertilizer 2 + labour (Urea) 50kg	67,000		74,000		74,000		75,000		67,000		135,000	
Weeding 2	80,000	42,000	20,000	70,000	20,000	10,000	10,000	40,000	30,000	50,000	150,000	70,000
Fertilizer 3 + labour (Urea) 50kg	67,000		74,000		74,000				67,000			
Weeding 3		30,000	20,000					40,000			180,000	70,000
Bird Scaring		50,000						80,000	80,000	50,000	70,000	70,000
Bags For Harvest	20,300	11,669	17,825	8,060	10,500	7,000	14,000		16,250	13,000	14,000	5,600
Harvesting	100,000	80,000	80,000	90,000	80,000	50,000	80,000		70,000	70,000	100,000	80,000
Loading and Unloading	43,500	33,340	71,875	19,500	22,500	15,000	40,000		37,500	30,000	40,000	12,000
Transport (Field to Drying)	43,500	33,340	71,875	19,500	22,500	15,000	40,000	8,000	50,000	40,000	30,000	12,000
Drying	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Milling									62,500	50,000		
Storage (3 Months)	58,000	33,340										
Cost of loan												
Total production cost	**910,300**	**548,689**	**941,575**	**497,060**	**725,500**	**282,000**	**811,000**	**398,000**	**979,250**	**569,000**	**1,274,000**	**587,600**
Total yield per acre	29	17	29	13	15	10	20	4	25	20	20	8
Average selling price per bag	47,500	75,000	62,000	70,000	47,500	60,000	47,500	60,000	65,000	70,000	47,500	70,000
Total Revenue per acre	**1,377,500**	**1,250,250**	**1,782,500**	**910,000**	**712,500**	**600,000**	**950,000**	**240,000**	**1,625,000**	**1,400,000**	**950,000**	**560,000**
Profit per acre	**467,200**	**701,561**	**840,925**	**412,940**	**-13,000**	**318,000**	**139,000**	**-158,000**	**645,750**	**831,000**	**-324,000**	**-27,600**

Appendix 5- 6 cases detailing comparative costs of production and income of irrigated/dryland rice (Chris Mdee)