

The Role of Capital Assets and Institutions in the Success and Failure of Smallholder Irrigation Schemes in South Africa

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ABSTRACT Production among smallholder irrigation farmers in South Africa is low, and is negatively influenced by a wide range of factors. This paper documents the findings of a study of two smallholder irrigation schemes in South Africa, by applying the sustainable livelihoods framework to identify factors affecting their performance. The two schemes, namely the Foundation Community Project and the Mooi River Irrigation Scheme were examined in terms of the five basic forms of capital assets (natural, financial, physical, human and social) to understand their impact on performance. The results show that poor coordination of government funded activities negatively affects smallholder performance, through poor provision of public infrastructure like roads and physical assets like tractors. Smallholder farmers lack irrigation specific skills like scheduling and irrigation maintenance, hence poor productivity and poor irrigation infrastructure condition. Financial capital was also identified as a constraint among smallholder irrigators. Although farmers capitalise on the existing social capital that enable borrowing of small amounts of unsecured funds from relatives and neighbours to fund irrigation activities, informal sources of income did not provide adequate financial resources to boost production and marketing activities. To ensure successful management of smallholder irrigation schemes, specific training to enhance knowledge and information building among smallholder farmers as complementary assets to improve the functioning of other capital assets is recommended.

INTRODUCTION

Irrigation is frequently seen as a mechanism for poverty alleviation and achieving sustainable livelihoods through improving agricultural production, generating income, providing employment opportunities and providing opportunities for diversification of livelihoods (Smith 2007; Wenhold et al. 2007; Tapela 2008). In South Africa, farming (including irrigation schemes) forms only one aspect of rural communities' livelihood strategies (van Averbeké and Mohamed 2006; Cousins 2013), and it has been shown that access to irrigation can reduce the poverty status of rural communities (Sinyolo et al. 2014). While water has been called 'the dividing line between poverty and prosperity' (Wenhold et al. 2007), in practice many irrigation schemes in South Africa are failing and do not provide the anticipated benefits (van Averbeké et al. 2011). It is recognised that a range of capital assets are

required to improve smallholder irrigation performance (Namara et al. 2010). Access, control, and ownership of productive assets such as land, labour, finance, and social capital enable people to create stable and productive lives, yet relatively little is known about how agricultural development is constrained by the differential access to and control over the assets (Meinzen-Dick et al. 2011).

The paper applied a Sustainable Livelihoods Framework (SLF) to explore two smallholder irrigation schemes in South Africa in terms of the contribution that various forms of capital assets and the existing transforming structures and processes make to the functioning of the schemes and the livelihoods of their members (Fig. 1). The paper, whose objective was to explore the role of capital assets and institutions on the success or failure of smallholder schemes, was part of a broader five year project funded by the Water Research Commission (WRC) of South Africa (project number K5/1879//4), entitled: "Analysis of food value chains in rainfed and irrigated agriculture to include emerging farmers in the mainstream economy" (WRC Knowledge Review 2012-13 KSA4). The two schemes differ in terms of scale, organisation and operation; hence the SLF broadens understanding of the factors that

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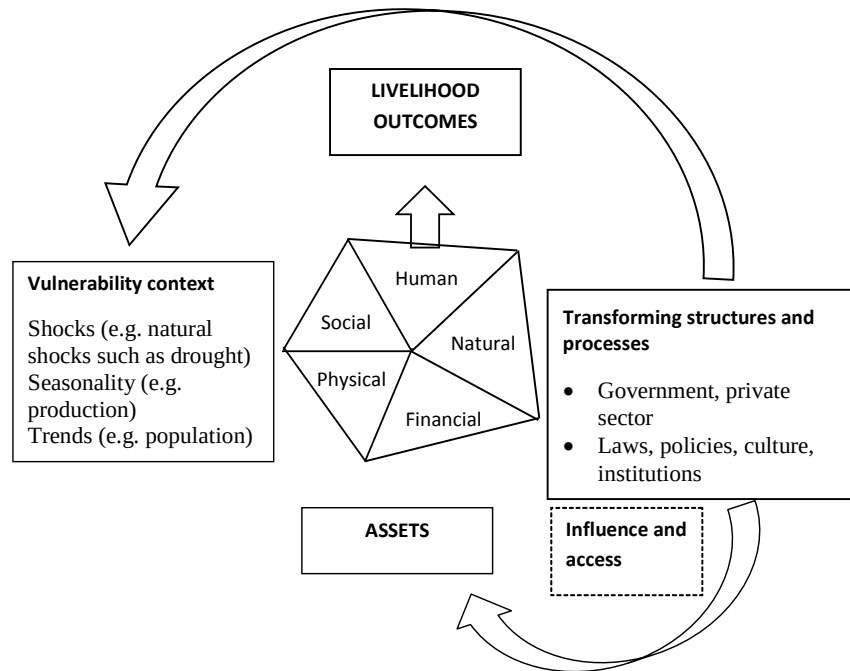


Fig. 1. The sustainable livelihoods framework

Source: Adapted from DFID 1999

affect the success of irrigation schemes by providing contrasting insights. To the best of the authors' knowledge, the SLF has not previously been applied in this way to allow for an analysis of irrigation schemes.

The second section of the paper presents a discussion of the conceptual framework used for the analysis and a description of the research methodology. The results and discussion sections are presented in the third section, including a summary of the key factors affecting the functioning of the two schemes. The conclusions and policy implications are presented in the fourth and fifth sections respectively.

CONCEPTUAL FRAMEWORK AND METHODOLOGY

Conceptual and Empirical Framework

Smallholder irrigation farmers rely on a range of assets to achieve their livelihood outcomes (Ahmed et al. 2008), which can be analysed using the sustainable livelihoods framework (SLF).

The framework was developed by Department for International Development (DFID) as a planning tool for development activities and for evaluating the impacts of existing activities so as to identify entry points for supporting livelihoods in farming communities (DFID 1999; de Satgé 2002; Hinshelwood 2003). It considers the capital assets as well as the transforming structures and processes, which influence households' vulnerability context as well as their asset base. The core principles of the SLF are that it is people centred, holistic, dynamic, and bridges the gaps between the micro-and macro-environment (Murray 2008). Within the context of SLF (Fig. 1), capital assets are typically categorised as human, social, physical, natural and financial capital. Through the use of the SLF one is able to identify ways of enhancing livelihoods, strengthening asset bases and reducing vulnerability (De Satgé 2002; Ahmed et al. 2008). The SLF ensures a holistic analysis of the smallholder assets and their operating environment. Improved access to all forms of capital assets is expected to improve performance of farmers in terms of productivity, livelihoods and food security status.

Description of Study Sites and Sampling

The two irrigation schemes that form the basis for this comparative analysis are the Foundation Community project (FCP), in the Mbashe Local Municipality in the Eastern Cape Province and the Mooi River Irrigation Scheme (MRIS), in Msinga Local Municipality in KwaZulu-Natal Province. The two schemes were selected based on a criteria developed to meet specific requirements of the funding organisation. Key to the selection criterion are; the functional state of the irrigation schemes; participation of the members in any of the available product markets (formal or informal); willingness of the farmers to participate in the project; growth potential of the irrigation projects so that the research will empower more farmers and there should be no visible signs of farmer fatigue due to over participation in research activities

A combination of individual questionnaires, focus group discussions (FGDs) and key informant interviews were used to collect data. The sample comprised of 20 and 71 irrigation farmers from Foundation Community Project (FCP) and Mooi River Irrigation Scheme (MRIS) respectively. The FCP is small and therefore stratification was not necessary. On other hand, MRIS is large, with a total of 824 irrigators in 15 blocks. Therefore, the sampling procedure in MRIS ensured proportional representation of the 71 sampled farmers drawn from each of the 15 blocks. A total of two and three focus group discussions were conducted with irrigators in FCP and MRIS respectively. The paper adopted the SLF as its analytical framework. Through qualitative data analysis, the data was grouped into themes covering the various forms of capital assets (human, social, financial, physical, natural) for the two irrigation schemes, to understand the influence of various forms of capital on irrigation farming. Where quantification of the variables takes place, descriptive analysis was also used to describe the findings.

RESULTS AND DISCUSSION

Descriptive Analysis of the Two Schemes

The two smallholder irrigation schemes present some similarities and differences in terms of land size, irrigation infrastructure, institutional arrangements and livelihoods strategies. Farmers in Foundation Community Project revealed

that 80.5% of households received government grants. Despite having access to irrigation, farming was not mentioned by the respondents as a major source of income. Most households (97.6%) had home gardens and all were fully utilised. Of the 20 community members interviewed, only 7.5% grew for marketing purposes – and this was in combination with home consumption. The situation was similar at the MRIS, where livelihoods are diverse to increase and stabilise household incomes. The local community members grew a range of crops within the scheme, home gardens and kept livestock. Non-farm income generating activities were diverse in the area and include brick making, making *mbadada* (Zulu sandals), beadwork, wood-work and house construction. Furthermore, community members, like FCP members had guaranteed sources of income in the form of government social grants.

The Availability of Capital Assets and Impacts of Transformative Structures

The capital assets available to the scheme members, as well as the transformative structures and processes that have impacted on their success / failure at the two sites are discussed.

Natural Capital

Both irrigation schemes are located on perennial rivers, the Shixini River in the Eastern Cape and the Mooi River in KwaZulu-Natal. The Mooi River sometimes runs low, but releases from the Craigieburn Dam upstream ensure that flow is maintained. Land allocation per individual is limited at the MRIS. On average farmers have access to 0.268ha (ranging from 0.1ha to 1.4 ha), which comprises approximately three plots measuring 0.1ha each. When asked about their satisfaction with the land allocation, 64% of respondents were satisfied, while 36% wanted more land. The FCP is a 66ha irrigation project located near Willowvale town in the Mbashe Local Municipality. However, the fenced land area available for cultivation was also limited, equating to 0.35 ha per member, though it was used collectively. Furthermore, the soil at the FCP was frequently waterlogged, which might have had a negative impact on crop production. The waterlogging was due to a combination of factors including lack of irrigation scheduling skills among irrigators as well as the inherent nature of the soil.

The importance of human capital to ensure efficient utilisation of other forms of capital is therefore noted. Land was also available for expansion but the members' capacity to make use of this was limited by weak financial asset base, lack of skills and labour (human capital) and physical capital which mainly resulted in poor road infrastructure. At the MRIS, access to additional land adjacent to the river was very limited and the land under irrigation was largely all allocated, although some possibility of internal negotiation did exist when farmers wished to lease irrigation land.

Human Capital

Human capital relates to skills level as well as ability/capacity to provide labour. Basic education levels affect literacy and numeracy, and the ability to calibrate equipment, read instructions, while skills training related to agriculture can improve production through better irrigation scheduling, fertilizer application, etc. Farmers in FCP have low levels of education, where 9% of the respondents had no schooling, 43% had primary school education, 46% had secondary school education and 2% had tertiary education. This potentially affected group decision making of the cooperative. As such the coop relied on its project coordinator for the day to day running of the scheme. The FCP coordinator was a key member of the group, having attended a number of agricultural short courses and thus bringing this knowledge to the project. Over the years he managed to build strong communication skills and confidence to approach potential markets and negotiate prices. It highlights the vulnerability of the group as all skills were housed with one person. In general the project was characterised by poor production and record-keeping skills.

At MRIS, the survey revealed an even more compromised situation, with scheme members having on average two years of formal schooling. They had some production skills training but no irrigation-related training had been provided, which respondents identified as a critical gap. Much of the knowledge about crop management has been sourced from input suppliers who provide information relevant to smallholder production. Social capital and networks was the major form through which irrigators improved their human capital. Besides training by

extension officers, farmers acquired skills informally through seeking guidance from neighbours, friends or relatives who know specific tasks such as fertilizer application and disease control. Therefore, the role of social networks and trust was identified as a key aspect in human capital development.

Lack of technical skills at FCP relating to the maintenance of the tractor and the pump was affecting irrigation performance. The FCP had one tractor and one irrigation pump. The tractor was routinely serviced once a year by an externally hired mechanic. However, the situation was different for the irrigation pump that had been installed in 2007 had not had its oil changed since installation. This was likely going to lead to the rapid deterioration of the pump condition. Farmers lack mechanical skills, hence for the pump to get serviced, it has to be transported to the nearest town where qualified technicians can do the service. Alternatively, irrigators could negotiate and invite the technician to service the pump on-site. Either way, farmers did not have a suitable transport to take the pump for service, and at the same time could not afford to hire a serviceman to come and service the pump on-site, consequently the pump never got serviced for 4 years. This finding was consistent with other researchers (Perret 2002), who noted the prevalence of irrigation infrastructure collapse due to poor maintenance. At MRIS, tractors are hired from the Msinga Local Municipality, Msinga Department of Agriculture and private individuals; hence irrigators are not involved in their maintenance. The Msinga DoA had a total of 24 tractors to service both rain-fed and irrigation farmers through-out the Msinga Local Municipality. Only six of these tractors were allocated to the farmers within and around MRIS. However, frequent breakdowns and shortage of drivers often affected the availability of the tractors.

Furthermore, lack of technical knowhow, equipment and financial means also influenced farmers' inability to undertake any repairs to the road leading to the scheme. Farmers' expectations for the local municipality to maintain the road to the scheme, and the support has not been forthcoming, hence the heavy deterioration of the road. This was evidence of reliance on government support by smallholder farmers as noted by (Dennison and Manona 2007; Perret 2007). The farmers did not consider alternative forms of transport like animal power to facil-

itate the movement of produce from the field to the market. Huge volumes of fresh produce were therefore left to decompose in the fields, resulting in loss of revenue.

The aspect of human capital also affects labour availability at farm level. The farmers at FCP attempted to address the problem of labour shortages in the scheme by encouraging younger members under 35 years of age to join without paying the joining fee. However, the success rate was very low, indicating the unpreparedness of the youths to venture into agriculture, where financial returns are very low. Youths were prepared to join the scheme only if there was a fixed monthly allowance paid to the farmers, which was not sustainable due to the low production levels. At the MRIS, farmers depended on both family and hired labour on most of their farming operations. Hired labour was sourced from the local community and a wage rate of ZAR30/day was paid, which were below the minimum stipulated by government of ZAR105/day for farm labour (RSA 2013). This was a reflection of the limited employment opportunities, which made hired labour to accept the very minimal wages and at the same time low financial returns from smallholder irrigation farming can also be the reason for the low wages.

Financial Capital

Access to financial capital was a challenge for members of both projects. Irrigators from the two schemes were asked to indicate their major sources of household income. In FCP, 80% of the respondents indicated that government grants formed the major and guaranteed source household income, followed by casual labour (9.5%) and family remittances at 7.14%. The grants comprised of old age grants, child support grants and disability grants. A similar trend was observed in MRIS where 60% of the irrigation farmers considered grants as guaranteed income source. However, more than 40% of the irrigators indicated that agriculture was their major source of income in MRIS, unlike at FCP where agriculture was not considered a major income generating venture. More than 50% of the sampled farmers were aged and further explains why significant percentages of them had to rely on different forms of gifts/remittances. Furthermore, 62% of the farmers in FCP and 64.8% in MRIS, used informal sources of credit,

and farmers in both schemes had no access to formal sources of credit. Although limited access to credit and finance prevents farmers from accessing inputs, the risk of poor yields at production level and lack of collateral also prevents farmers from relying on formal credit. As such, informal sources of credit from relatives, neighbours and friends, which are based on trust and kinship was common in both schemes. These sources are favourable to farmers because no interest was charged on the borrowed finance. The borrowing arrangements were anchored on reciprocity where farmers assist one another financially or in kind, in times of need.

The role of government as the major source of funding for irrigation development was evidenced at FCP. In MRIS, no cash funding was directly given to the scheme by government agencies, besides input support like potato seed, fertilisers and fencing. Besides the ZAR250 000 funding made available to the FCP by the Eastern Cape Provincial Department of Social Development (DoSD) to improve the scheme, including input acquisition, the members had also provided interest-free loans to the project. The cash loans provided by the members were used to purchase inputs to sustain the project. When members did not have cash to buy inputs, their operations were delayed. Joining and annual subscription fees were ZAR100 and ZAR20 respectively and were not sufficient to support operations. At the MRIS, individual farmers generally covered their own operating costs, except for some support received by co-operative members from provincial Department of Agriculture, for example, fertilisers and potato seed. Like other schemes in South Africa (Mnkeni et al. 2010; Fanadzo et al. 2012), the study showed that a shortage of inputs (due to the cost thereof) led to underutilisation of land within the scheme. Farmers also mentioned a shortage of cash to pay labour as well as a shortage of funds to finance marketing activities. For the two schemes, no suppliers provide input credit facilities for the smallholder farmers. The reliance on the cash market by the smallholder farmers require adequate medium term planning in order not to disrupt production activities due to lack of finances or inputs. It was revealed that some farmers often use welfare grants from the government to finance their farming activities, to avert the challenge of finance to buy inputs.

Physical Capital

Physical capital was explored in terms of infrastructure as well as machinery, equipment and tools. The irrigation infrastructure available to the two schemes was very different. At the MRIS, the scheme had a system of concrete canals that drew water from the Mooi River and distributed it throughout the 15 irrigation blocks. Leakages, siltation and unregulated use of water within the conveyance structures (across all blocks) posed a challenge of equitable water distribution. Supply of water to tail-end blocks was severely compromised, unreliable and reflected the challenge of managing common pool resources, and was consistent with other irrigation studies (Mbatha et al. 2008; Sserunkuuma et al. 2009). Due to unreliable canal water supply, tail-end blocks of MRIS supplemented irrigation through pumping using a diesel pump provided by provincial Department of Agriculture and Environmental Affairs. The farmers had concerns that the pump had insufficient capacity and the cost of fuel was too high to afford them full irrigation. Sinyolo et al. (2014) noted the use diesel powered pumps did not solve water supply problems in Tugela Ferry Irrigation Scheme mainly because of frequent breakdowns and the high cost of fuel. Although FCP was still receiving funding for fuel, evidence of incapacity of the farmers to fund the pumping costs after future state withdrawal was revealed. The revelation was important and points to the need to focus more on less costly and technologically simple systems like short-furrow gravity systems as recommended by Crosby et al. (2000).

In terms of other infrastructure, the MRIS was serviced by a fairly well maintained gravel road that ran alongside the scheme ensuring reasonably easy access to transport compared to the poorly maintained and inaccessible road at FCP. The perimeters of the irrigation schemes were fenced, but some farmers in MRIS had fenced their individual plots as a sign of poor condition of the scheme fencing. The lack of any kind of storage, marketing or packaging structures at MRIS was a challenge, especially for farmers producing perishable crops such as spinach. Harvested produce was placed in the shade of trees and bushes while waiting for buyers. This led to wastage due to the high temperatures that characterised the area.

In terms of access to machinery and equipment, 62% of farmers at the MRIS hired tractors for land preparation while 28.2% relied on human labour and 9.9% made use of animal traction. This was in contrast to FCP that had a tractor and various implements like mould board plough, disc harrow and planter for the project. However, the tractor at FCP proved not to be an effective asset because they did not have a trailer to improve commodity marketing and the project members did not have the skills to maintain and repair it (illustrating a constraint of human capital).

In MRIS, farmers hired tractors from the local municipality and the provincial Department of Agriculture. However, access was constrained due to delays by the authorities to dispatch tractors to the farmers who would have paid the hiring fees. Farmers therefore preferred to make use of privately hired tractors. Another challenge faced by farmers in MRIS pertains to access to light delivery vehicles (LDVs) or '*bakkies*' for transporting produce to markets. Sometimes such vehicles actually served as marketing points as produce was sold directly from them in nearby towns. None of the interviewed farmers owned a light delivery vehicle, but respondents revealed that there were three community members who hired out their LDVs to farmers. The farmers also relied on '*bakkie traders*'¹ to sell their produce; hence there was no need to hire LDVs. A few farmers had LDVs, but they spent long periods selling from their vehicles, which highlights the conflict between production and marketing when the same individual undertakes both concurrently. This also pointed to the need for a viable market to which they rather deliver their produce. For farmers not owning LDVs, the cost of hiring them was very high (ZAR400 for a round trip to Greytown) and thus most such farmers relied on farm gate trading to buyers purchasing from the scheme. In contrast, the members at FCP also saw the lack of vehicles as a serious challenge for the project – both for buying inputs as well as for transporting produce. *Bakkie* owners were not prepared to hire-out their *bakkies* to scheme members due poor road condition leading to the scheme. The challenges of physical capital identified in the two schemes raises the transactions cost of doing business by smallholder farmers, which consequently result in them quitting farming in the long-run.

Social Capital

Social capital is necessary if other forms of capital are to have real benefits (Grootaert 1998), especially in performing collective action activities, where a number of individuals must contribute to achieve the desired outcomes (Ostrom 2004). Social capital is sometimes defined as either cognitive (for example norms, values and beliefs) or structural (for example roles, networks and relationships) (Liverpool-Tasie et al. 2011). As such, social capital considered the nature of the relationships that exist between members of the schemes as well as the relationships that exist between scheme members and the broader community. In the case of the FCP, the community was willing to support the project – initially in terms of making land available and later in terms of buying their produce. The lease agreement between the community and the project members relied on a good relationship between them. It emerged that some community members wanted the land back for their own use. The market relationship with the community was however negatively impacted by the fact that some community members wished to buy produce on credit and then defaulted on their payments. This led to the members taking a decision to discontinue this practice. The benefit of being able to dispose of large quantities of produce locally rather than facing costs of transporting it to external markets should not be underestimated. This relies on very good relationships with the community together with other sources of capital such as access to physical capital that allows the members to carry the produce to a selling point that is more accessible to the local community.

Another gap in terms of social capital was the lack of a relationship with the sister project of DoSD, Ciko Santrini, which was located in the neighbouring village and also drawing water from the Shixini River. There could have been opportunities for joint ventures in terms of accessing labour, sharing labour or marketing produce so as to meet requirements for bigger volumes, but this had not been pursued – either by project members or by the government departments that support them. It might have been of value for the projects to consider opportunities to strengthen the individual projects through some form of collaboration, rather than seeing each other as competitors.

One frequently cited benefit of strong social capital is the opportunity for collective action (Baiyegunhi 2014). At the MRIS, where farmers generally produced individually, there was a lack of collective action and mutual respect, which was required for the maintenance and operation of the irrigation scheme. Farmers in the upper blocks extracted water outside the regulated times. As a result, some farmers, especially those in the lower blocks ended up not getting access to adequate irrigation water. Water allocation procedures were in place, indicating which blocks could irrigate on any particular day, but compliance was poor. This non-compliance with irrigation scheduling is not unique to the MRIS and was found to have resulted in conflict at the Tugela Ferry Irrigation Scheme, which is also located within the Msinga Local Municipality (Sinyolo et al. 2014). In addition, at the MRIS, there was diversion of water from the scheme by non-members to plots outside the scheme. This added pressure to the already stretched water system. As suggested by Namara et al. (2010), technical interventions such as rehabilitating infrastructure or introducing new crops need to be complemented by institutional interventions such as improving water management processes to ensure equity in water distribution along the scheme.

At the MRIS, the extent to which collective action was facilitating access to inputs was also limited. However, there were some incidences where farmers informally constituted themselves as groups and gave their money to one farmer who then went to town and bought items on behalf of the others. The cooperative operating at Block 14 and 15 had also bought cabbage seed collectively through the block committee. According to respondents, lack of trust was generally the reason for individual farming and input acquisition although it was also due to practical considerations such as the timing of activities not allowing for collective action (Muchara 2011). While the farmers at the FCP had no linkages with large-scale commercial farmers due to their location, the situation was different at the MRIS because of the existence of commercial irrigation farmers across the Mooi River. While some members felt that the commercial farmers monopolised use of the river and took more than their share of water, MRIS farmers also benefited from the commercial farmers as

the latter had the capacity to engage with the Department of Water Affairs and negotiate releases of water from the Craigieburn Dam when the level of the Mooi River was low.

Although relationships with customers or markets are another form of social capital, these were not very clearly defined in both schemes. The relationship between farmers and buyers were based on verbal agreements and not on written contracts. Any party could move out of the relationship without facing any penalties, and no guarantees existed to ensure a definite market for the farmers or definite quantities of produce for the buyers. A big challenge for the FCP was the fact that they had no reliable market relationships and no contracts with buyers. Initial relationships that were established with local retailers dissolved over time due to a number of factors including the poor accessibility of the project. This led to retailers preferring to collectively purchase a range of produce from the fresh produce market at East London (about 300km return trip) than to purchase from local projects. At MRIS, farmers had established relationships with some hawkers, which facilitated market access. At 20% had contact details of a trader who could procure their fresh produce. However, discussions with traders revealed the challenges of dealing with smallholder farmers, such as lack of grading of produce and lack of consistent supply of the produce across seasons. This had a negative impact on the producer-buyer relationship. Given that more than 90% of farmers interviewed indicated that they marketed some proportion of their produce and yet did not have proper access to markets, this needs to be addressed by the local municipality or the provincial Department of Agriculture (DoA). The Mkondeni Fresh Produce Market in Pietermaritzburg (300km return trip) is not a viable option due to distance and high transport cost. Long yields and poor coordination of production activities hampers the opportunities of lowering marketing costs through collective marketing.

The Impacts of Transformative Structures and Processes

Transformative structures (and the related processes) that were found to be impacting on the success of the two irrigation schemes were categorised as government departments, private sector enterprises and community-level struc-

tures (traditional authorities and irrigation scheme committees). In some instances the impacts positively affected the functioning of the schemes, but often this was not the case.

Government Departments

A number of government departments, including both provincial Department of Agriculture (DoA) and the Department of Social Development (DoSD), were involved in farmer support programmes, especially among community members who would have formed groups and registered themselves as cooperatives. The challenge was that these groups were frequently not spontaneous initiatives and have only been formed as a means of accessing funds. Support provided by government departments was therefore often not adequate (Mudhara 2010). For example at the FCP, training and mentorship was found to be lacking. To some extent this was because there was a lack of clarity regarding the roles and responsibilities of the departments especially the Department of Agriculture as the custodians of farmer training services and the Department of Social Development as the funding organisation. There were concerns that the approaches of the two departments with regard to the management of the schemes were different. The two departments were not liaising and the DoSD was accused of not taking production related advice from DoA extension officials. The DoSD did not have personal with agricultural skills and this weakened their implementation and funding strategies for agricultural cooperatives. The other reason given for inadequate extension support were the inadequacy of transport for extension staff and the poor condition of the road, which were said to limit access to the site.

Furthermore, in the case of the FCP, the processes that were put in place to ensure that government funds were not misallocated took decision-making powers away from the group members. All financial expenditures are supposed to be approved by the funding organisation, which is the Provincial Department of Social Development (DoSD). To this arrangement, farmers complained of delays in approval of cash withdrawal request, with some being rejected as beyond the scope of the project. The government processes did not have the flexibility to address major farming issues, where decisions should in

fact be taken by the committee rather than by DoSD officials. For instances, farmers believed that their inability to move produce from the field was the factor that was most limiting their success. Although the funds were available, the DoSD could not approve the purchase of a trailer because the funds were meant to cover operating costs excluding capital investment (purchase of trailer) and labour.

At MRIS, the provision of tractor ploughing services was one problematic aspect of government service delivery. While farmers complained of delays and drivers working for limited hours, the departmental officials highlighted that there were factors that limited the efficiency of the service such as the fact that the tractors and the fuel were kept at the main offices of the agriculture department in Tugela Ferry (approximately 40km away from the scheme), which meant that they had to travel daily to the scheme, and this reduced the number of hours available for working. Decentralising the management of tractors and fuel to the local offices of the department of agriculture whose offices are within the scheme, might improve productivity per tractor, by reducing idle and travelling times.

Private Sector Including Input Suppliers and Traders

In terms of the private sector contributing positively to the functioning of the MRIS, some input suppliers provide production information to farmers, while local smallholder farmers that own tractors provide ploughing services. These structures overcome challenges resulting from other players not providing an effective service to farmers at the scheme. Umtiza Corporation is an input supplier in the Eastern Cape that could potentially have provided a service to the FCP through a public-private partnership that existed between Eastern Cape Department of Agriculture and Umtiza at the time of the study. This partnership had however not yet delivered on these expectations. Lack of policy, clarity on the role of private players in government funded programmes and incomplete contracts hinder the success of public-private partnerships. Nevertheless, it highlights a realisation by government of the need to establish such partnerships to improve service delivery to smallholders.

Individual hawkers and traders that came to both schemes, but especially MRIS, can be cat-

egorised as private sector individuals that provide a service of transporting and marketing fresh produce on behalf of the farmers. Farmers highlighted marketing as the main gap related to the private sector, which is constrained by limited access to market information in both schemes. At FCP, the coordinator engaged with potential markets and negotiated prices and conditions of sale, while farmers at MRIS relied on bakkie traders and hawkers who buy fresh produce in bulk to sell on the informal urban markets. The common feature of the two schemes is the reliance on informal and unreliable markets. No market contracts exist between farmers and the private or public institutions for both schemes.

Community Management Structures and Processes

Community management structures include the various committees as well as local traditional authorities. The land allocation process at the MRIS is one example of a process that involves the traditional authority and the various scheme committees. Generally, farming plots were allocated to households and were registered in the name of the household. In MRIS, inheritance was the key mechanism through which people obtained access to land within the scheme. There was also an opportunity whereby new members could access unallocated plots through the traditional allocation system. Community members in need of land would present their request to the village headmen and in consultation with irrigation committees vacant plots are allocated to the approved applicants. The applicant upon making a once-off payment of ZAR50 to the chief (*inkosi*) would then have full access to the plots.

There was no vacant / unallocated land available within the MRIS. Majority of new entrants into the MRIS access plots through leasing land from non-active owners with use rights to the irrigation plots. There were informal systems in place regarding the renting of plots by members either to non-scheme members or to other scheme members, leading to access to multiple plots by some irrigators. Payment for plots was either in cash (generally ZAR300 for a 0.1ha bed for a single cropping season) or in the form of a portion of the crop produced. In both cases, there were only verbal agreements, and this limited the level of security of land ownership for

those renting. The land rental system was to some extent encouraged by the local rules that governed land usage at MRIS – in particular the fact that plot holders were expected to use their plots productively and were not allowed to leave them fallow as this could lead to the build-up of insects, pests and diseases. In addition all unused land was supposed to be re-allocated to individuals on the waiting list. In reality, enforcement of these rules was said to be problematic. One reason cited for this was the challenge of power relations due to social links (through extended family relations, kinship) of MRIS members with both traditional leaders and irrigation committee members. Also, inheritance-related issues were cited where families not using land would not give it up as they said their children might need it at a later stage. Nonetheless, farmers who were not utilising their land were encouraged to lease the land out to avoid losing it. By so doing, the land remained productive and could not be repossessed by authorities. One complication resulting from farmers accumulating additional beds within a single block was that there was insufficient time to irrigate all blocks on the same day, since a farmer is allocated only one day of irrigation per week. This led to night-time irrigation, water theft and irrigation on days allocated to other blocks.

The FCP uses a slightly different approach of land management than MRIS. While the traditional authority is involved in land allocation, fallow land belonging to community members was consolidated and made available to the FCP for irrigation farming through a ten year lease agreement. As such, no further fragmentation of the land occurred since the irrigators farmed collectively. Similar to the rental system in MRIS, insecurity regarding ownership of land pending the expiry of the lease agreement in 2017 was causing uncertainty among FCP members, which can be resolved by either permanently transferring the land to the project or finding an alternative irrigable land for the cooperative.

Key Factors Determining the Functioning of the Smallholder Irrigation Schemes

From the outcomes of the study presented above, both cases had a suite of capital assets, but ultimately it was the presence of ‘gaps’ that limited the effective use of these assets. In addition, there are cases where interventions to de-

velop one form of capital would be able to offset the negative impact of another factor (for example better knowledge of irrigation scheduling and land preparation procedures, or access to finances for engineering works could to some extent overcome the problem of waterlogging that is experienced at FCP). While there are generally no categories of assets where no gaps were identified, it becomes clear that there are often one or two key factors that hampered the performance of the irrigation schemes (Table 1).

In the case of FCP, some of the gaps identified were that production was compromised by pump breakdown and delays in its repairs impacted negatively on production activities. In some instances FCP relied on personal loans from members to buy inputs, emanating from delays by the DoSD, which was the funding organisation to release money for certain activities. This partly affected farmers in terms of volumes of inputs that could be purchased at a given time. Furthermore, lack of a vibrant market led to the FCP to sell their produce through credit to the community members. However, the facility had to be stopped due to an increasing number of defaulters on payments, which impacted negatively on existing social capital and financial viability of the project.

Ultimately, the key factor that limited success of the FCP was the poor road condition, which contributed to the failure of relationships with local market outlets and traders who previously supported them. There appeared to be a lack of clarity regarding the roles and responsibilities of the various government departments (at various spheres of government) that supported them. The DoSD insisted that it was not possible to use the funds which were available for purchasing a tractor trailer, which the members saw as a mechanism for addressing the challenge of the poor road access. Thus the final impact of this combination of factors was the inability of the project members to market their produce. The project was also very vulnerable because it relied on the skills and enthusiasm of one individual who was involving himself in other activities since the project was not performing optimally. Loss of this person, coupled with the ever worsening condition of the access roads could have been the final factor resulting in collapse of the project.

In the case of the MRIS, the performance of individual farmers was limited by a number of factors including the small land allocations, the

Table 1: Key factors impacting negatively on FCP and MRIS schemes 2013

<i>Categories</i>	<i>Foundation Community Project</i>	<i>Mooi River Irrigation Scheme</i>
<i>Natural Capital</i>	• Soils prone to waterlogging	• Limited land allocations
<i>Human Capital</i>	• Lack of irrigation scheduling skills • Low education levels, affect decision making processes. Reliance on one educated coordinator makes the scheme vulnerable in case the individual resigns from the scheme.	• Lack of mechanical skills to repair irrigation and farming machinery • Lack of irrigation scheduling skills • Lack of cooperation in canal maintenance and water management activities. • Low education levels, affect decision making processes • Lack of cooperation in collective marketing
<i>Financial Capital</i>	• Reliance on personal loans from members to buy inputs, limits the growth potential of the scheme.	• Lack of financial resources to purchase a tractor trailer negatively impact on the project's marketing activities. • Shortage of funds to cover inputs and marketing activities, result in some plots lying fallow. • Unavailability input credit facilities affect timely access to input due to financial constraints.
<i>Physical Capital</i>	• Bad access roads to site negatively affect marketing of produce. Shop owners and hawkers stopped procuring from the scheme due to inaccessibility.	• Unequal distribution of water negatively affects crop production. Plots in the tail-end section of the scheme are mostly affected; hence fallow plots are common, as farmers quit farming. • Bad infield roads negatively affect harvesting of bulk produce like cabbages and potatoes at MRIS.
<i>Social Capital</i>	• Trading of vegetable produce to community members on credit was based on trust and kinship. However, some local community members defaulted on payments for produce so the scheme could no longer offer purchases on credit.	• Weak institutional structures in MRIS negatively affect farmer compliance to rules and regulations governing production, resource allocation and marketing of produce. • Lack of cooperation and commitment required for water allocation and maintenance of the infrastructure, lead to unequal distribution of water, hence poor yields in some sections of the scheme.
<i>Transformative Structures and Processes</i>	• Lack of clarity regarding roles of Department of Social Department and Department of Agriculture, where the latter is the financial sponsor yet they have no technical knowhow, while the former have the expertise but no control over how the scheme production and finances are managed.	• Control of funds by Department of Social Development limited the decision-making capacity of members, but centralising the process around its officers, who have no agricultural background. This affected the viability of FCP • Land allocation no longer functional and rental procedures don't provide security. • Weak regulatory framework provided by MRIS committee relating to the allocation of irrigation water to different blocks.
<i>Key Factors Responsible for Poor Performance of the Scheme</i>	• Poor road access, which impacted on ability of the project to market their produce.	• Marketing and production skills were mainly housed within the project coordinator. • The lack of a reliable water supply for farmers in the middle and lower blocks, combined with marketing challenges • Lack of human skills to coordinate collective production and marketing of produce

Source: Survey data 2010/11

lack of skills related to irrigation scheduling, the shortage of funds to cover inputs and marketing activities and the need for repairs to some of the irrigation infrastructure, however, the chal-

lenges that hindered farmers' performance, especially those in the middle and lower blocks, was the shortage of water due to lack of compliance with the schedule and the lack of reliable

markets. This situation was also documented by Sinyolo et al. (2014), who noted that water related conflicts were rife at the Tugela Ferry Scheme because of non-compliance with the irrigation schedule and because those at the upstream were perceived to be drawing too much, than their counterparts at the downstream. The diversity of needs, resources and contexts of schemes, as demonstrated to some degree in this paper also calls for scheme-specific interventions rather than having blanket solutions that are applied across schemes.

CONCLUSION

The paper, whose objective was to determine the key factors affecting the success or failure of irrigation farming, applied a sustainable livelihoods framework (SLF) to explore two smallholder irrigation schemes in South Africa. The findings have shown that for irrigation projects to be successful they need to have access to the full suite of capital assets, including the transformative structures and processes that influence the extent to which farmers' needs are met. The lack of compliance with the irrigation scheduling and the unwillingness of some members to engage in collective action, such as cleaning the canal, illustrated a local need to tap into the social capital asset of the members. This affected the farmers' levels of production, especially those whose plots were located towards the tail-end of the scheme.

While these are the main factors limiting the success of the schemes, the discussions above have shown that sub-optimal performance is a result of a number of factors, some of which are interconnected. Analysis of the schemes using the SLF shows that all forms of capital are important, though one issue can ultimately lead to the failure of a scheme. Natural capital exists within communal irrigation schemes, though the land resources may not be optimal and land allocations limit the scale of production and potential for generating income. The lack of access to credit facilities affects farmers' ability to procure inputs.

Technical infrastructure maintenance skills are limiting the development of smallholder irrigation development, as evidenced by poor maintained of irrigation pumps and equipment at farm level. Farmers are exposed to generic training in agriculture through government extension officers, but lack irrigation specific training like

scheduling and maintenance to improve productivity. The shortage of skills directly affects the effectiveness of human capital, especially in terms of farmers' production and business skills at smallholder level. Collective action around irrigation maintenance and provision of labour to perform certain activities, strong relationships with the local community and with other actors, especially market players, is lacking at scheme level.

RECOMMENDATIONS

The findings of the paper highlight the need for service providers to undertake a participatory process of problem identification with farmers in order to understand the underlying problems that need to be addressed. It is also important for service providers to take into account the range of different factors that impact on the farming enterprises, as addressing one, while ignoring other issues, is unlikely to have a meaningful impact. It is also clear that it does not help to provide irrigation schemes with physical capital such as inputs or infrastructure, without addressing social or human capital needs. There is a need for intergovernmental platforms to facilitate dialogue and coherence between government departments. Learning from the case studies, government departments whose core is not in farming should consider partnering with other departments with the required human skills to implement certain projects. Partners should therefore be identified for specific projects, where skills are not readily available within the funding organisation. However, innovation platforms should embrace more than governmental entities by considering all stakeholders. Specific training to enhance knowledge and information building among smallholder farmers as complementary assets to make capital assets function better is recommended.

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NOTE

- i. *Bakkie* traders are informal brokers who buy fresh produce from farmers to sell in the neighbouring towns. The name came from their use of light delivery vehicles (LDV), which are also known as *bakkies*, to ferry their produce from their clients to the market.

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