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Smallholder drip irrigation in Burkina Faso:

The role of development brokers

Author version of

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Abstract

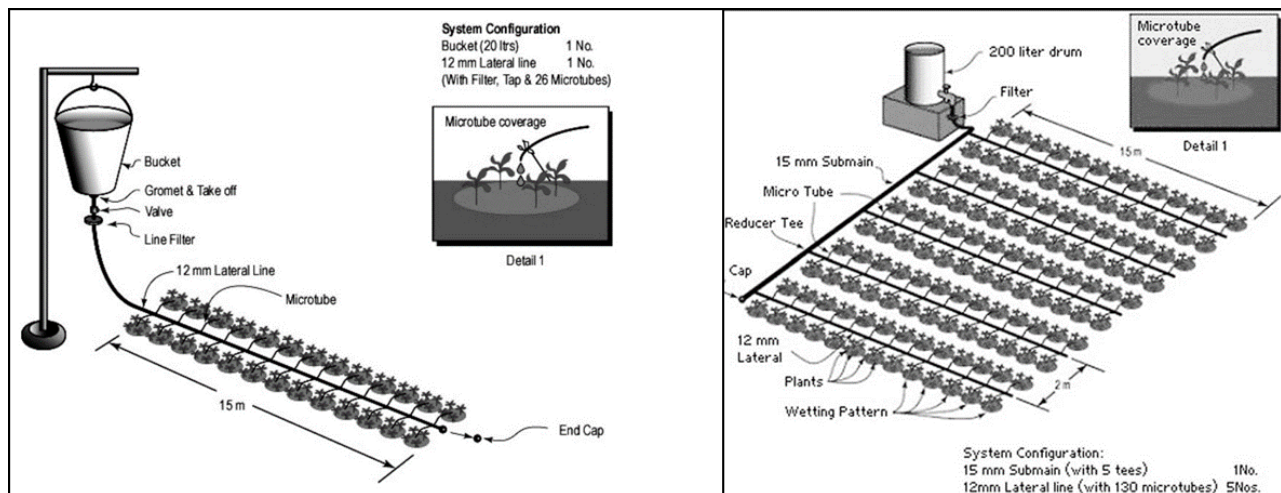
Smallholder drip irrigation is widely held as a promising technology for water saving, poverty reduction and food security despite a dearth of evidence of benefits to farmers, especially in sub-Saharan Africa. In this paper, we document three development programs promoting drip irrigation in Burkina Faso. Using Actor Network Theory and insights from critical development studies, we show that development brokers play a key role in aligning interests, shaping activities and interpreting project outcomes. They are accountable towards each other rather than to farmers. This means that success is interpreted through development agencies lenses and with the intention of continuing involvement in future projects. Small farmers' interests and uptake of the technology are of secondary importance.

Key words: Brokerage, innovation, development aid, water resources, sub Saharan Africa,

Introduction

Drip irrigation is a method to supply water in small and frequent quantities to the root zone of crops through a system of perforated plastic pipes. Initially associated with capital-intensive forms of agriculture, efforts to specifically design drip irrigation systems for smallholder farmers began in the late 1990s, first for small scale farmers in South Asian countries. Smallholder drip systems take the form of “drip kits”¹ (See Polak, Nanes, & Adhikari, 1997; Postel, Polak, Gonzales, & Keller, 2001) and exist in different types (see figure 1). Regardless of the type and the manufacturer, the overall principle is the same: the ‘drip kit’ operates under low pressure to provide localized irrigation to a small plot, from a few square meters to a few hundred square meters.

Figure 1. Schematic diagrams of smallholder drip irrigations systems (Source: Left (Postel et al., 2001); Right (Polak & Yoder, 2006))



Smallholder drip irrigation is widely presented as a promising option for poverty alleviation and sustainable intensification because it allows to efficiently use water for the production of high-value vegetable crops (for instance Pasternak, Nikiema, Senbeto, Dougbedji, & Woltering, 2006; Postel et al., 2001; Woltering, Ibrahim, Pasternak, & Ndjeunga, 2011). As such, and from the mid 2000s onwards, international research institutes, non-governmental organisations, national governments

and aid agencies have started promoting it in sub-Saharan Africa. Although often dubbed as an ‘agricultural water management strategy’, smallholder drip irrigation is significantly different from the soil and water conservation strategies that have long been promoted in sub-Saharan Africa. The latter aimed at rehabilitating degraded soils through better control of rainfall and runoff and improving soil fertility management; they often built on ‘indigenous’ practices to increase the productivity of rainfed cereals, the mainstay of rural livelihoods (see for instance Douxchamps, Ayantunde, & Barron, 2014; Reij, Tappan, & Belemvire, 2005). Smallholder drip irrigation, in contrast, is an alternative method to the calabash and watering cans that are commonly used for vegetable gardening, which is an off-season activity conducted on small plots and depending on labour and water availability.

Burkina Faso is one of the countries where development initiatives centred on the promotion of smallholder drip irrigation have multiplied over the last 10 years (see Wanvoeke, Venot, Zwarteveen, & de Fraiture, 2015). This multiplication of development projects is testimony of a widely shared enthusiasm for smallholder drip irrigation among a variety of actors: national government, local and international NGOs, private companies, research organisations, aid agencies. So far, this enthusiasm is not backed up with evidence of success in farmers’ fields. Our own observations are in line with studies that suggest that the use of drip irrigation remains limited to experimental or pilot sites. Farmers seldom use drip irrigation without external support and almost invariably stop using it once development projects come to an end (Belder, Rohrbach, Twomlow, & Senzanje, 2007; Kulecho & Weatherhead, 2005). Similar to what has been observed in many other cases in which specific crops or technologies are being promoted by development agencies, this lack of uptake and enthusiasm of farmers can be attributed to a number of factors. These include the still high costs of initial investments (Dittoh, Akuriba, Issaka, & Bhattarai, 2010); technical problems

(with emitters and filters clogging and deterioration of material) due to unreliable and low quality water supply and harsh environmental conditions (for instance Friedlander, Tal, & Lazarovitch, 2013); lack of spare parts, supply chains and support mechanisms (Belder et al., 2007); difficulties to access markets (Kulecho & Weatherhead, 2006); a lack of capacity and knowledge on the part of smallholders and a misfit between the technology and the cultural setting (Garb & Friedlander, 2014). New projects often explicitly set out to address the above constraints, for instance through technological improvements, more integrated approaches (including micro-credit schemes and links to market), enhanced participation, etc.

We turn towards the field of Anthropology of Development, and more specifically towards recent ethnographic studies of aid, to propose a different explanation of the discrepancy between the lack of results on farmers' fields and the continued enthusiasm of development actors for smallholder drip irrigation. We focus on the 'making' of on-going development efforts around this technology and draw from Mosse (2005) suggestion that it is the interpretation of events, rather than the events themselves, that is pivotal in creating policy enthusiasm for particular development approaches or technologies. It follows that the success of a project (or of a technological package) not so much stems from what it does for its end-users, but instead is the result of the existence and activities of a supportive coalition: network of actors devoting their energies to maintain a coherent representation of that specific project or technological package. In our case, this representation is that of drip irrigation as a suitable technology (because of its size and affordability, and because of the efficiency with which it uses water) to meet the needs of smallholder farmers in sub-Saharan Africa, and thus to realize the goals of water saving (or environmental conservation) and poverty alleviation, while also helping improve food security.

Our analysis thus aims to unravel the network of development actors who shape and underpin the promotion of drip irrigation in Burkina Faso, a Sahelian country of West Africa. We describe the strategies they use and the reasons they have to do so, as well as the relations of interdependency that tie these multiple actors together. The next section further develops the analytical framework of the study around the notion of brokerage as discussed by anthropology of development and science and technology scholars. We then present our methodology, before a detailed description of three development programs promoting drip irrigation in Burkina Faso. The discussion draws generic lessons about the networks and practices of drip irrigation development in Burkina Faso. Finally, a short conclusion reflects on what brokerage means in the context of development, beyond the facilitation of an innovation process.

Brokerage and translation

In Burkina Faso, and more generally in West Africa, drip irrigation reaches smallholder farmers through development projects, which still are the preferred mode of intervention of development agencies and non-governmental organisations despite repeated calls for programmatic and sectoral support since the Paris declaration in 2005.

Anthropology of development scholars have long highlighted the key role played by development brokers (*courtiers en développement* in French) in shaping the reality of these projects (Bierschenk, Chauveau, & Olivier de Sardan, 2000, 2002). They have proposed understanding of brokerage as a process, going beyond the normative representation generally associated to this activity of intermediation, as for instance found in rural innovation studies (Klerkx, Hall, & Leeuwis, 2009).

Discussing brokerage in relation to place-specific interventions, scholars of the anthropology of development have defined development brokers as these “project’s local social carriers, at the

interface between the people (the ‘target group’) aimed at by the project and the development institutions” (Bierschenk et al., 2000, p. 8). Development brokers are the “social actors implanted in a local arena [...] who serve as intermediaries who drain off [...] external resources in the form of development aid” (Bierschenk et al., 2000, p. 8). They can be extension agents, project staff, community leaders, locally elected officials, etc.

Within critical development studies, ideas of brokerage also exist, but do not just apply to the ‘local’. Drawing from Actor Network Theory (ANT), Lewis and Mosse (2006) for instance talk of ‘translation’ to refer to an activity that encompasses the production and stabilization of knowledge, meanings and interpretations. In a similar vein, Rottenburg (2009) sheds light on the important role that development experts and consultants have in ‘translating’ projects activities and outcomes as they often mediate between funding agencies and national governments. Lewis and Mosse (2006) go one step further in arguing that the mutual enrolment and interlocking of interests within networks of actors (funding and governmental agencies, NGOs, research centres, private companies, pilot farmers, etc.) is what produces project ‘realities’: multiple actors engage in joint work to produce and sustain a coherent vision regarding a specific sphere of intervention.

Through their use of the notion of translation, these scholars in critical development studies deal with themes that have long been central to science and technology studies and innovation studies. These two fields are particularly relevant to us given our study object, drip irrigation, which has a strong material dimension. Scholars in innovation system studies tend to adopt a more structural view on brokerage than development anthropologists. They indeed see brokers as ‘key facilitators’ for the diffusion of technological innovations, or in other words, for their success (see among others Klerkx et al., 2009). Science and technology scholars and notably ANT theorists, on the other hand,

highlight that the very definition of the success of a technology is the result of creating interest and coalition building (Akrich, Callon, Latour, & Monaghan, 2002).

Though using slightly different definitions of the terms brokerage and translation and though used in relation to different study objects, scholars in critical development studies, innovation studies, and Science and Technology Studies all shed light on a similar phenomenon, that of '(inter)-mediation' within a network of actors (people, organization) and objects. Because of the key importance of intermediation in shaping policy interventions, development projects, or technological artefacts, they argue that intermediation deserves thorough analysis.

In this paper we analyze the process of intermediation for the case of smallholder drip irrigation in Burkina Faso. We use three case studies to illustrate the role of brokers, interpreting it beyond that of facilitating the diffusion of this new technology. We map the actors involved in drip irrigation, describe their activities and identify their relations of dependency and accountability. By doing so, we set out to generate a different interpretation of the fate and travels of smallholder drip irrigation. To date most, if not all, drip irrigation studies have focused on understanding the constraints and opportunities smallholders in the developing world face in using drip irrigation. In our analysis, we turn the research gaze to those promoting the technology in an attempt to shed light on, how 'it makes its way' to them.

Methodology

We used a three tier methodology. First, from June 2011 to November 2012 we interviewed 44 employees from international and national development agencies, government officials, Non-Governmental Organizations, and private companies involved in the promotion of smallholder drip irrigation in Burkina Faso. Second (November 2012 to November 2013), we visited 28 out of the

87 drip irrigation sites we had identified through interviews to gain a better understanding of the implementation modalities of drip irrigation projects and of drip irrigation-in-use. In addition to interviews and field visits, we participated in two promotional (demonstration) events organized in Ouagadougou and Koudougou around smallholder drip irrigation. Third, we selected three case studies of development programs promoting smallholder drip irrigation at the time of our study (2011-2014). Our primary objective with these case studies was to analyse the network of actors that underpinned these initiatives. We selected the Scaling Up Micro Irrigation Technologies project (SUMIT); the *Projet d'Irrigation et de Gestion de l'Eau à Petite Echelle* (PIGEPE, Small Scale Irrigation and Water Management Project); and two linked SDC projects namely *Approche Intégrée pour le Développement de la Maraîcherculture* (AIDEM, Integrated approach for vegetable farming development) and its successor *Programme de Développement du Maraichage par l'Irrigation Goutte à Goutte* (PDMIG, Program for the Development of Vegetable Farming through Drip Irrigation). The three cases were selected to cover a diversity of institutional arrangements between multiple actors; they were also described by many as being the most prominent initiatives promoting drip irrigation at the time. In each case, we conducted an in-depth analysis of the projects' documentation (notably appraisal, progress, and evaluation reports), we interviewed staff of the funding and implementing agencies and of the organisations providing support and services to the main implementing agencies. Finally, we visited some of the sites of these projects and participated in project events (Table 1). In the case of the SUMIT project, we conducted follow-up interviews to collect additional information in February 2015.

Table 1. Characteristics of the case-studies

	Scaling Up Micro irrigation Technologies (SUMIT)	Projet d'Irrigation et de Gestion de l'Eau à Petite Echelle (PIGEPE)	Programme de Développement du Maraichage par l'Irrigation Goutte à Goutte (PDMIG)
Funding agency	Swiss Agency for Development and Cooperation (SDC)	International Fund for Agricultural Development (IFAD)	Bureau de Cooperation Burkina/ Swiss Agency for Development and Cooperation (Buco/SDC)
Implementing agency	International Development Enterprise (iDE)	Ministère de l'Agriculture, de l'Hydraulique et des Ressources Halieutiques (MAHRH)	General des Services (GEDES)
Regions of implementation	North, Centre	South West, Central-West, Central South	North, Centre
Number of interviews	8	10	7
Number of field sites visited	7 ³	5	10
Number of projects events attended	2	1	1

Source: The authors (2015)

Development projects: brokering drip irrigation

Case 1: Scaling Up Micro Irrigation Technologies project

The SUMIT project is a 5 year long and US\$ 4 million project (2011-2015) funded by the Swiss Agency for Development and Cooperation. It aims at creating a market for drip irrigation in Burkina Faso. The project is implemented by international Development Enterprises (iDE), an international NGO, seen by many in the sector as a social enterprise. Moving away from subsidies, iDE insists on selling rather than giving products for free or at reduced prices. It received significant attention for its work in south Asia in the late 1990s/early 2000s and extended its operations to sub-Saharan

Africa in the late 2000s. iDE has long focused on designing affordable water technologies. In line with its development philosophy of supporting the emergence of small-scale entrepreneurs, it disseminates these technologies according to market principles. iDE believes that system guarantees the sustainability of development interventions (Heierli & Polak, 2000); (see Venot et al., 2014 for a critical analysis).

iDE opened its Burkina Faso office in 2011 and used the project to structure its operations in that country.² Significant efforts went into raising awareness about drip irrigation. First, iDE created a ‘technology centre’ in Yamtenga (close to the capital city, Ouagadougou). The centre is a facility where affordable water technologies (such as drip irrigation systems and treadle pumps) are developed and tested. It can also be used to train farmers, public extension agents and NGO staff in installing, maintaining and monitoring drip irrigation systems. At the same time, the technology centre is an element of iDE’s marketing campaign to promote its products (in September 2014, for instance, senior officials of the World Bank and partners in the region coordinating the Sahel Irrigation Initiative visited iDE’s technology centre). In addition to the technology centre, iDE has established demonstration sites in 4 provinces of the country (Yatenga in the Northern region, Kadiogo in the Centre region, and Sanguié and Boulkiemdé in the Centre-west region). iDE heavily invests in promotional campaigns through local media (TV channels, newspaper, radio, etc.) where results obtained in the technology centre and other demonstration sites are showcased.

At the time of the writing of this paper, iDE worked with 8 retailers and 9 farm business advisors who serve as intermediaries to disseminate drip irrigation systems (www.ideburkinafaso.org). iDE and retailers have a contractual agreement establishing the conditions under which iDE products are sold. Retailers are small scale merchants and traders often, but not always, specialized in selling agricultural equipment. They do not provide further support to farmers other than selling the

equipment. Farm Business advisors (FBAs) are currently full staff of iDE with a base salary, a percentage on each product sold and a bonus both meant as financial incentives to further FBAs initiative.³ iDE expects the drip irrigation market to expand and volumes of sales to increase, hence it envisions that FBAs will be independent and profitable ventures on their own by 2017 (without any further financial support from iDE; <http://www.ideburkinafaso.org>).⁴

FBAs are located throughout the 4 target provinces of the project and their contract with iDE includes maintaining and monitoring drip irrigation demonstration sites, promoting and selling iDE's products, providing after-sales services⁵ and serving as relays between retailers selling iDE products and smallholders who express an interest in using drip irrigation. Most FBAs have been hired for their marketing and communication skills and often have an agricultural background. Further training regarding drip irrigation's technical aspects was provided to them.

One of the cornerstones of iDE's philosophy is that poor farmers and small entrepreneurs only buy what they really need; they will therefore only invest in specific products if these yield rapid benefits (Polak, 2008). This philosophy establishes the volume of sales as the primary indicator of success, and frees the promoter of the responsibility to evaluate the actual use of the technology by smallholder farmers (who, indeed, being poor, would buy something (s)he expects would not have positive results). The distinct focus on the volume of sales clearly transpired during several of our interviews with FBA and other technical and management staff of iDE. It also clearly transpires from the blackboard that welcomes every visitor to iDE office in Ouagadougou and indicates the volumes of sales achieved by the organisation and updated monthly.

In parallel to the SUMIT project, iDE is also involved in other initiatives. According to the iDE-Burkina Faso director, the idea of social enterprise and more generally of private-led rural development appears to have little traction in Burkina Faso (interview on October 2013). This

observation echoes findings by Abric et al. (2011) who highlight that the Ministry of agriculture is reluctant to devolve the implementation of externally funded development projects to private companies, despite experiments held as promising by development aid agencies. This is why in order to expand its activities and establish itself as a key player in the sector, iDE has actively sought partnerships with other NGOs and development projects, to which it sells drip irrigation kits, and in some instances, its expertise in installing and monitoring drip irrigation use. In January 2015, and according to iDE's own records, 85% of all kits (that is nearly 3,600 kits) had been sold to other development organisations (including Burkinabè associations and NGOs, international NGOs, and governmental projects) and the remaining 15% (about 650 kits) to private farmers. This strategy to engage with other development actors was clearly articulated by the iDE- Burkina Faso director during one of our interviews:

“I made a lot of efforts to get contracts with projects and development agencies [...] without it, there is little prospect for farmers to buy and use drip irrigation. Projects and NGOs are our best opportunities to sell our drip irrigation equipment” (Source: iDE-Burkina Faso, interview data, 06 December 2012)

Case 2: Scale Irrigation and Water Management Project

PIGEPE is a project funded by the International Fund for Agricultural Development (IFAD) and OFID/OPEP. With a total budget of US\$19 million over six years (2008-2014), the project was implemented by the *Ministère de l'Agriculture de l'Hydraulique et des Ressources Halieutiques* (MAHRH, Ministry of Agriculture, Hydraulic and Fisheries), through a Project Management Unit (PMU) specifically set up for this purpose and operating from Gaoua, the regional capital of the South-Western region of Burkina Faso. The project targeted 6 provinces, located in three regions of

Burkina Faso (South West, Central West, Central South), and aimed at improving the living conditions of 19,500 rural families by increasing agricultural productivity through better access and control over water resources (IFAD, 2007). This was meant to happen through the implementation of demand-driven micro-projects submitted by farmers with the support of intermediaries (NGO, extension agents, mayors, etc.). However, the choice for smallholder drip irrigation had already been done at the design stage; one of the targets of the project indeed was the dissemination of 15,000 drip kits over 600 sites (IFAD, 2007).

To do so the PMU first entered in an agreement with Irrigation du Faso (IRRIFASO), a Burkinabé private company created in September 2009 to distribute smallholder drip irrigation systems manufactured by the biggest irrigation equipment company worldwide, the Israeli firm NETAFIM. The first agreement between PIGEPE and IRRIFASO was established in 2011 for the provision of 390 drip irrigation kits and did not include support or after sales services, even though, according to the executive officer of IRRIFASO, this is what is the most profitable to them:

“We don’t gain enough money if we only sell NETAFIM drip kits. The sale of our expertise is more beneficial to us than the sale of the drip kits themselves” (Source: IRRIFASO Executive Officer, interview data, 18 October 2012).

Despite the limited profitability of this first contract according to IRRIFASO staff, the establishment of an alliance with a large-scale governmental project is in line with the company multi-fold strategy to establish itself as the country’s major provider of drip irrigation systems (hardware) and expertise (software) in this field. IRRIFASO often claims being the sole and official representative of NETAFIM in Burkina Faso⁶; it has set up a drip irrigation demonstration site used during conferences, workshops and international visits to showcase the potential of drip irrigation and the

expertise of the company, with the aim to extend its customer base for the provision, installation, maintenance and support of drip irrigation. Further and as clearly expressed by the company's manager, IRRIFASO aims to participate to all major meetings pertaining to water and agriculture in Burkina Faso:

“No one can talk about drip irrigation in Burkina without IRRIFASO. We are not only selling drip kits. We provide technical expertise on the installation and maintenance of drip irrigation which is more important for our company. We are always invited to workshops and conference and to train people to use drip irrigation” (source: IRRIFASO Executive Officer, interview data, 18 October 2012).

IRRIFASO's strategy clearly was successful. In 2012, a new contract between the PMU and IRRIFASO was signed for the training of 60 extension agents of the Ministry of Agriculture and some pilot farmers (PIGEPE, 2012). The training sessions focused on the technical basics of drip irrigation: recognizing, assembling and installing the different elements of the drip irrigation kits.

PIGEPE nevertheless ran into difficulties in achieving the targets set by the project design document. By the end of 2012, IRRIFASO had supplied 1260 kits of 100 m² and 282 kits of 500 m² and the PMU declared having installed 488 drip irrigation kits without specifying their type (PIGEPE, 2013). It is remarkable that the only indicator of progress used in project reports is the number of drip kits installed. Indicators such as the number of kits in actual use, production levels, profitability for farmers, the extent of water and labour savings etc., are conspicuous by their absence. It is assumed that kits are actually used by farmers, and that this use is leading to improved food security and livelihoods, without any studies being done on the above. For the PMU and the funding agency, distributing drip kits appears to be an end in itself.

In 2013, and following difficulties in ensuring a steady supply of good quality drip irrigation kits from IRRIFASO,⁷ the PMU entered into an agreement with iDE for the supply of 2700 kits, the establishment of several demonstration sites, and the training of private distributors and extension agents regarding the technical aspects of drip irrigation. The signing of this contract followed an evaluation mission of the PIGEPE project in June 2012; it also finds its roots in personal professional relationships. Based on previous work experience, the evaluation mission leader (who was also part of the PIGEPE formulation team in the mid 2000s), was indeed well-acquainted with iDE's experience in the promotion of low cost drip irrigation elsewhere. He also knew the Burkina Faso country director personally (from his previous employment at IFAD), who joined the evaluation mission in 2012 as an observer (interview data, October 2013).⁸ The contract had to be discussed at length, because of the given strong ideological differences between PIGEPE (operating on a subsidy and transfer mode) and iDE (which aims to operate according to market principles). An agreement was finally reached, whereby the kits are subsidized at 85% but sold through a network of small private distributors allowed to make a profit. This agreement served both the objectives of the PMU (i.e. reaching the project's goals) and those of iDE (i.e. extending its sphere of operations). In October 2014, during a phone interview, the agent of the PMU in charge of overseeing the dissemination of drip irrigation mentioned that 310 kits of 500m² and 1260 kits of 100m² had been installed, still much less than the ambitious objective of the design document.

Case 3: Projects financed by SDC-Burkina Faso: AIDEM and PDMIG

The Burkina Faso office of the Swiss Agency for Development & Cooperation (SDC-BuCo) started financing drip irrigation projects in 2007 immediately after the end of the African Market Garden

(AMG) project.⁹ The first project SDC-Buco financed was called AIDEM. It was implemented in three villages (Ouahigouya, Koumbri and Tikaré) of the northern region by Optima Conseils Services (OCS) between 2007 and 2010. OCS is a private consulting company (Bureau d'étude in French) that was set up for the occasion by a former staff member of SDC-BuCo. Following a similar institutional setup and partly involving the same project partners as in the AMG project, AIDEM was implemented in collaboration with the decentralized offices of the MAHRH. The *Institut National de l'Environnement et des Recherches Agricoles* (INERA, National Institute for Environment and Agricultural Research (INERA) and the *Centre Suisse pour la Recherche Scientifique* (CSRS, Swiss Centre for Scientific Research) supplied OCS with drip irrigation kits (left over from the previous AMG project) and coordinated research to evaluate the performance of drip irrigation. Additional drip irrigation kits were procured from IRRIFASO.

Following a positive evaluation of AIDEM (BuCo, 2011), SDC-BuCo decided to fund another 4-year (2011-2014) project, the PDMIG. GEDES (Générale des Services), another private consulting company, replaced OCS. As a result of this, OCS, whose very existence depended on the promotion of drip irrigation through AIDEM had to close. This new partnership is no coincidence. GEDES, a bigger organization than OCS created in 2000, had a history of collaboration with SDC-BuCo in the fields of decentralisation and governance. In 2010, GEDES added water and natural resources management (as well as health and sanitation) to its portfolio of activities, positioning itself as a 'natural partner' of SDC-BuCo for the implementation of PDMIG. PDMIG allowed GEDES to significantly grow in size (in addition to the purchase of material and vehicles, the organisation indeed hired 8 new staff). A private company called Kali Service was identified through an open call for tenders to sell drip irrigation kits. Our interview with the manager of this company clearly

revealed that this was an opportunistic move on her part. Selling drip kits was a business opportunity, like any other:

“I started with drip irrigation just as a business and to make money. I don’t know anything about the technical aspects of drip irrigation. My job is to buy and sell. I am a business person selling drip kits to GEDES” (source: Director of Kali’s service, interview data, 21 September 2012).

Once the contract awarded and the drip irrigation kits sold, she stopped working in this field to focus on her poultry farm located in Ouagadougou.

The PDMIG project mostly consisted of the establishment of 15 drip irrigation demonstration sites, seen by many as farmer field school (Champ Ecole Paysan in French), a widespread modality of agricultural extension adopted by projects in Burkina Faso. GEDES identified pilot farmers through the provincial farmers’ union, built a cemented water reservoir and installed a drip irrigation system on their respective plots without any contribution from the farmers.¹⁰ GEDES extension agents visited the pilot sites every two weeks and organised collective field-trainings that, in practice, amounted to awareness raising events and brought together about 30 farmers in each pilot site. The number of participants ($15 \times 30 = 450$) to these mediatised events was then used as a key indicator of project’s progress even though GEDES’ program officer recognized that:

"We are doing our best to show farmers that drip irrigation is important for agriculture [...] Adoption level is low [...]. All our farmers irrigate the drip irrigation plots with watering cans when we are not there. We know it but we cannot do anything. It happens everywhere" (Source: GEDES program officer, interview data, 12 August 2013 and 11 September 2013).

Discussion: interdependencies and accountability

Our survey and key informant interviews allowed identifying eight projects for the promotion of smallholder drip irrigation in Burkina Faso since 2004. Table 2 shows that many development actors are involved in more than one project. The Swiss Development Cooperation (SDC) funded or co-funded four out of eight projects. USAID financed different projects too, while IFAD is involved in a single large-scale project that builds on previous experiences acquired in other countries such as Madagascar, India and Guatemala. iDE figures in four different projects, either as implementing agency or as supplier of kits and expertise. IRRIFASO supplied kits and training for two initiatives. INERA did research in one project and provided kits in another project.

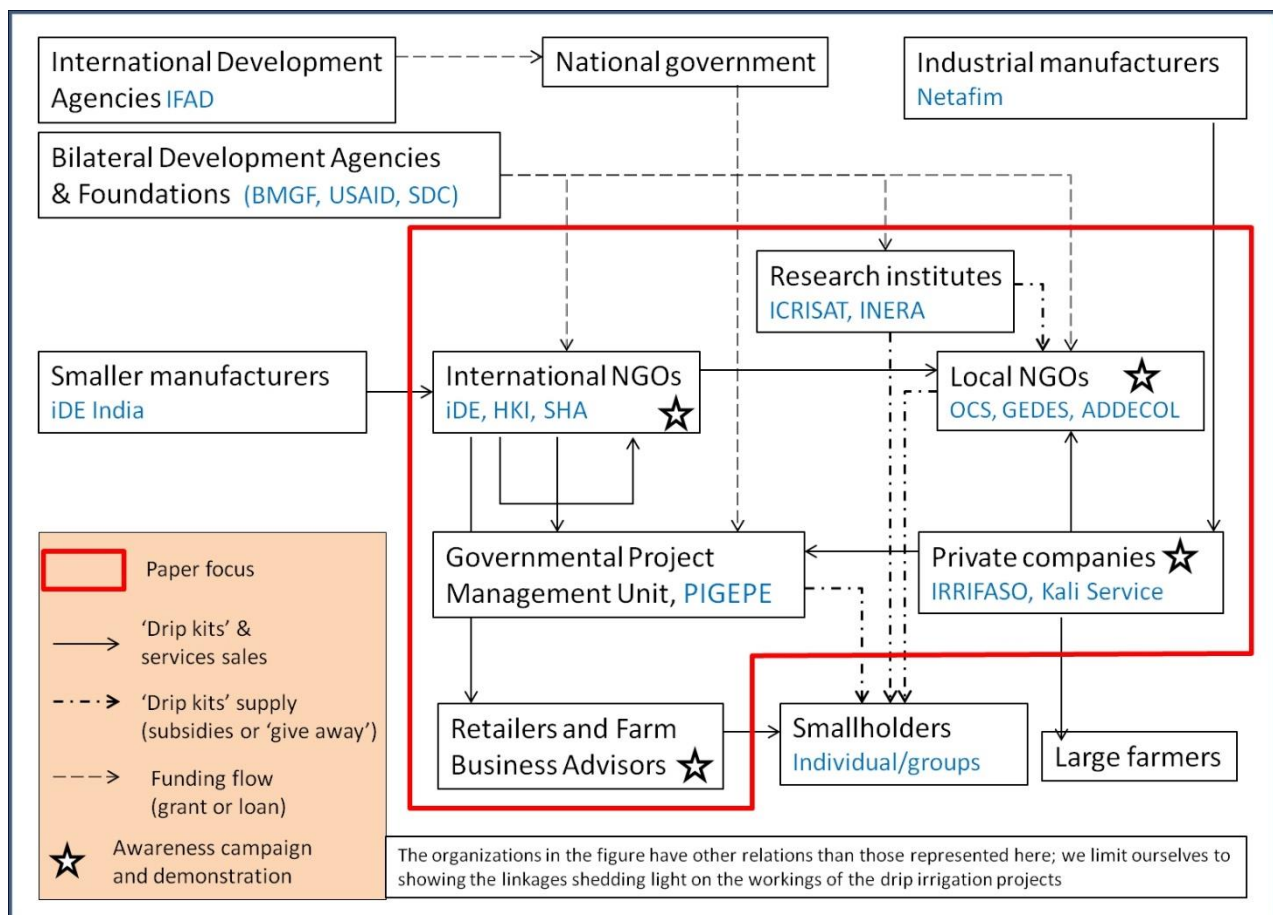
Table 2. Smallholder drip irrigation projects in Burkina Faso: An extended network of actors

Project Name	Funding agencies	Implementing agency (promotion, technical support, extension)	Kits and expertise providers	Periods
African Market Garden (AMG)	USAID/ Africa Care/ Swiss Development Cooperation (SDC)	ICRISAT, INERA	NETAFIM	2004-2007
Approche Intégrée pour le Développement de la Maraîcherculture (AIDEM)	SDC-Burkina Faso Office (SDC/BuCo)	Optima Conseils Services (OCS)	INERA	2007-2010
Drip irrigation promotion	IFAD	IFDC	IRRIFASO	2008-2012
Projet d'Irrigation et de Gestion de l'Eau à Petite Echelle (PIGEPE)	IFAD , OFID/OPEC & Government of Burkina Faso	Ministry of Agriculture (MAHRH)	IRRIFASO, iDE	2008-2014
Enhanced Homestead Food Production	United States Agency for International Development /Office of US Foreign Disaster Assistance (USAID/OFDA)	Helen Keller International (HKI)	iDE	2009-2012
Programme de Développement du Maraichage par l'Irrigation Goutte à goutte (PDMIG)	SDC-Burkina Faso Office (SDC/BuCo)	General des Services (GEDES)	Kali Service	2010-2014
Scaling Up Micro Irrigation(SUMIT)	SDC	iDE	iDE	2011-2015
Water use and sustainability in market gardening in Burkina Faso	Self Help Africa (SHA)	SHA, ADECCOL	iDE	2012-2013

Source: The authors (2015)

A closer look at four of these projects allows an in-depth mapping of the different actors involved in the sector and of their mutual relationships, represented in figure 2. This paper focuses on the organisations involved in ‘implementing’ drip irrigation projects in Burkina Faso (in the red square in figure 2). These organisations act as intermediaries between farmers and those organisations whose role mostly consists of financing development projects (international and bilateral development agencies, the national government) or supplying drip irrigation equipment.

Figure 2. Actors' linkages for the promotion and provision of drip irrigation in Burkina Faso (Source: The Authors, 2015)



Organisations in the red square of figure 2 can be broadly grouped into 6 categories. First, research institutes coordinating research for development projects that are focused on demonstrating the

suitability and performance of drip irrigation through pilot studies. Second, Burkinabé NGOs and, third, governmental development projects promoting drip irrigation, often in the form of demonstration sites (farmers' field schools) where drip irrigation systems are provided for free or at highly subsidized rates. The fourth category of actors consists of international NGOs providing drip irrigation equipment and expertise to local NGOs and governmental development projects. International Development Enterprise (iDE) holds a particular position among those international NGOs. It has preferential access to drip irrigation equipment from India (and supplies other actors with it), supports the emergence of small-scale private sector actors (retailers and farm business advisors, a fifth actor category, still very much dependent on iDE). Selling equipment and expertise to development agencies is crucial for iDE-Burkina Faso, but this also implies that iDE has less influence on the way drip irrigation kits are reaching farmers, and notably the level at which they are subsidized. Though it insists on fostering private sector entrepreneurship and despite its business-oriented rhetoric, iDE appears fully embedded and partly contributes to the public development aid sector. Small private companies selling drip irrigation equipment to NGOs, governmental projects and farmers constitute the sixth category of actors.

Figure 2 shows the relations between the different actors who form the coalition supporting the promotion of drip irrigation. Since 2004, when smallholder drip irrigation was first introduced in Burkina Faso, most of the development projects engaged in the promotion of drip irrigation made use of existing networks. The network is supported and sustained through personal relationships, flows of funds, equipment, project staff and concepts. For example, the PIGEPE PMU entered in an agreement with iDE following recommendations by the project evaluation mission in 2012. This collaboration was facilitated through the personal professional relationships between one member of the mission and iDE's country coordinator. Our interviews also revealed that the involvement of

Kali Service in one of the projects was based on the manager's acquaintance with the program officer of SDC-BuCo. Further, drip kits left over from one project (i.e. the AMG implemented by ICRISAT) were used in a different project later on (i.e. AIDEM implemented by OCS). This was facilitated by one actor (INERA) who was involved in both projects, albeit in a different role. The concept of farmer field school is used in different projects such AIDEM and PDMIG that take their clues from research organisations such as INERA and ICRISAT. Another example of a staff transfer is that of the drip irrigation technician of the PIGEPE-PMU who was previously working for INERA during the AMG project and was hired on the basis of this experience. Further, some of the distributors and FBAs now working with iDE had been working earlier with some of the other NGOs (such as HKI, GEDES or SHA) promoting drip irrigation.

Our analysis shows that development is shaped by multiple interactions between actors of different statuses, with varying resources and dissimilar goals. For these actors, drip irrigation often constitutes a means (among others) to achieve a broader objective; it may also represent a business opportunity or even a safety buoy supporting their own existence. Through drip irrigation, iDE for instance establishes itself as a key player in the agricultural water sector in Burkina Faso. This is the case for IRRIFASO too, which also pursues the goal of being a private profitable venture through the sales of drip irrigation equipment and expertise. Some local NGOs depend on drip irrigation to continue to exist. For instance, when OCS did not manage to partner with SDC-BuCo in the PDMIG project, the organisation collapsed. For such organisations, the stakes are high. Their existence depends on actively re-producing a positive imagery around drip irrigation. The extensive use of media to showcase the successful performance of drip irrigation is important here, which is why the projects produce radio programs and videos on pilot sites with pilot farmers. Though presented as an effective way to 'raise the awareness' of farmers, but they also prove very effective in convincing

donors and sustaining flows of funds from development agencies. The latter are all too happy to invest in the ‘promises’ of a technology that comes hand in hand with an agricultural model: the small entrepreneurial farmer producing high value crops for the market.

In Burkina Faso, drip irrigation remains an artefact that rarely travels outside of development cooperation spheres. Actors who promote it are highly dependent on external funds from bilateral and international aid agencies. Drip irrigation kit providers such as IRRIFASO and international NGOs such as iDE conduct most of activities with what they call ‘institutional clients’ such as the government and NGOs implementing drip irrigation projects. Direct sales to smallholders are very rare.¹² At best, the organizations we have discussed with are in contact with farmers through small scale retailers and business advisors. Most contractual agreements are between two development organizations; smallholders hardly feature in them. Contracts relate to the sales of a certain number of drip irrigation kits, at a certain price, and sometimes to monitoring and after sales support, which remain at best patchy. What happens after the sale is of little concern to the drip irrigation kit providers. Here, indeed, the market-based rhetoric takes over: if a ‘rational actor’ is ready to buy a drip irrigation kit, this must signify that he or she expects this to yield a positive return. Linked to the features attributed to the drip irrigation technology (modern, productive and efficient), this willingness to pay is sufficient guarantee. In this way, the supportive coalition can function ‘without the farmers’, which also means that the actors in the network are hardly accountable to them. In the coalition of smallholder drip kit supporters, sales or dissemination volumes become the primary indicator of success and are the focus of reporting, not the number of drip kits in use or the livelihood impacts. The latter are not ignored, they are just assumed to happen on the basis of experimentation in pilot sites receiving significant external support.

Conclusion

The number of development actors involved in the promotion of smallholder drip irrigation in Burkina Faso has been increasing since it was first introduced in 2004. Over the last decade, we identified eight major development projects involved in the dissemination of drip kits. Despite a lack of systematic data on uptake and livelihood impacts, aid agencies, government officials and NGOs staff widely present drip irrigation as a promising innovation for smallholders, one that allows turning subsistence farmers into small agricultural entrepreneurs. We show that such positive imagery comes about and is sustained through the strategic efforts of multiple development brokers and is reinforced via its circulation within this coalition.

In conventional innovation studies, brokers are seen as key facilitators who form an essential link between the providers/funders of an innovation and its end-users (see for example Klerkx et al. 2009). They are a 'positive force'. In the case of drip irrigation, the role of brokers and intermediaries has for instance been shown to be pivotal to the rapid expansion of this technology in the North African context (see for instance, Benouniche, Errahj, & Kuper, 2014; Poncet, Kuper, & Chiche, 2010). In the context of development, conventional innovation theory position brokers or intermediaries as dependent on and accountable to both international development agencies (upwards) as well as to smallholder farmers (downwards). In this setting, negative feedback on the usefulness of an innovation is immediately felt by brokers and project implementers: if smallholder farmers would not be using drip kits because they do not see the advantages, they would stop buying them, putting local NGO's and retailers out of business. Project implementers would not be able to reach project goals and ultimately, funding agencies would stop financing these projects. However, what we observed in Burkina Faso deviates substantially from this theory. We combined practice

based theory of innovation (Akrich et al., 2002) with insights from Anthropology of Development (Bierschenk et al., 2000; Lewis & Mosse, 2006) to explain why.

From our case studies we conclude that development brokers do much more than bridging the gap between those who design, fund and implement projects and smallholder farmers, i.e. the intended beneficiaries of innovations: they actively contribute to shaping the representations and successful outcomes of development projects. A large diversity of actors, such as local and international NGO's, government agencies, private companies and local retailers act as development brokers. In fact, there is not one single (type of) broker but, rather, a brokering network. This network of actors, often supported and sustained by personal relationships, facilitates the flows of money, equipment, ideas and staff (i.e. experience and knowledge) between different projects, and thus substantially influences project design and implementation modalities. Actors within the network create coalitions and interdependencies (for example, by signing contracts for the provisioning of equipment or training). Although their objectives of engaging in drip irrigation projects may be different, these objectives are nevertheless compatible or made compatible (i.e. selling equipment for profit, receiving funding, creating a market, reputation).

These actors are united in their desire to build and maintain an image of a 'successful innovation', something that is achieved by reporting high numbers of drip kits disseminated, showcasing demonstration sites, and telling success stories of pilot farmers on radio and television. Rather than to smallholders, actors in the network are accountable to each other and to those who provide funds for project activities. The consequence is that the actor network, which only includes a few select pilot farmers held as successful examples of innovators and entrepreneurial farmers, shapes new project activities and determines the ways success is measured and reported.

Thus shifting the analytical focus away from smallholder farmers (project beneficiaries) to the actors who promote smallholder drip irrigation yields a different explanation of why the technology continues to be hailed as a success in spite of little evidence of impacts in farmers' fields. We show that drip irrigation development projects work as resource arenas in which multiple actors tap to fulfil their objectives (Bierschenk et al., 2000; Meyer, 1995; Platteau, 2004). The motives of these actors are both altruistic - a desire to help farmers - and pragmatic - the wish to ensure personal advancement, status, or remuneration. The positive imagery and discursive success of drip irrigation in the developing world is not only linked to the technical attributes of the technology, but also importantly stems from the fact that drip irrigation serves important other functions: it helps generate hopes and funds; it creates new markets; it helps build and mobilise social networks, etc.

Our analysis of the making and practices of development projects and policies has relevance beyond the case of drip irrigation in pointing at how feed-back loops and accountability relations become distorted when development projects and actors overtly depend on outside sources of funding. As for Burkina Faso, our case studies highlight the still central role that public agencies have in shaping the way the epistemic community of development agents works, in spite of the private sector rhetoric of many development aid agencies. More broadly, our findings point to a worrisome lack of downward accountability in development cooperation. Concerns about reputations and survival create pressures to report success, providing strong incentives to all involved to use very selective measures and accounts of impact. Rather than reporting to end-users or final clients, or being influenced by the opinions and feed-back of ultimate beneficiaries, development actors depend for the continuation of their operations on the approval of each other and of funders. This vicious web of mutual dependencies can only be broken by allowing and indeed actively promoting beneficiaries to co-determine how development funds are (to be) used.

Endnotes

1. Smallholder drip irrigation is also called low cost drip irrigation; mostly because of its small size (typically between 20 m² and 1,000 m²) hence a low level of initial investment in comparison to conventional systems that are typically designed to cover several hectares. The term drip kit is used to describe a ‘complete’ drip irrigation system consisting of a manifold with a control valve, a filter, and a series of plastic pipes of different sizes, including the drip lines (also called laterals in Figure 1). It often comes in the form of a plastic bag or a carton box (see Wanvoeke et al., 2015 for a detailed description). The reservoir from which the water is drawn to supply the kit comes separately in the form of a plastic bucket, a drum barrel, a plastic tank, or a cemented reservoir. In 2015, iDE indicates a price of about \$30 for a 100 m² drip kit (with a similar amount needed for the water reservoir and ancillary equipment). Depending on the manufacturer, prices range between \$125 and \$250 for a 500 m² kit (these prices do not include the costs of the pump and reservoir needed to make the kit work, which are more expensive than the kit per se).
2. SDC is a historical partner of iDE; it financed some its projects in India in the early 2000s.
3. The bonus is calculated on the basis of sales volumes, the quality of maintenance of the demonstration site overseen by the FBA, the quality of the support provided to farmers, and the FBA’s marketing dynamism.
4. At the time of writing, iDE is experimenting to grant a larger degree of autonomy to some FBAs (this translates in a decrease in base salary and an increase in the level of interestment FBAs receive on each sale).
5. Our interviews reveal that after sales services are mostly limited to supporting farmers in installing the drip irrigation systems they bought. FBA sometimes monitor drip irrigation

systems “in use” but they do not see long-term support as part of their responsibilities, nor does iDE management (partly because of the costs that would be involved in doing so).

6. We could not verify the validity of this claim. Another small Burkinabé private company, Kali's Service, contested IRRIFASO's claim of being the exclusive retailer of NETAFIM in the country. Kali's Services stated it also imported NETAFIM equipment.
7. The difficulties to meet project's targets were attributed to cumbersome administrative procedures within IFAD, and to difficulties related to the import of equipment from Israel.
8. This PIGEPE project design document predates the establishment of IRRIFASO (in 2009) and of the iDE country office in Burkina Faso (in 2011). It however mentions iDE as a potential supplier of drip kits, to be imported from India.
9. The AMG project initiated and implemented by ICRISAT marked the start of smallholder drip irrigation promotion efforts in West Africa (see Wanvoeke et al., 2015).
10. GEDES considered land and motorized pump ownership as a prerequisite to be a pilot farmer under the project, meaning that only better-off farmers (linked to farmers' union) were directly engaged in PDMIG. GEDES justified this as the project involved building infrastructure (a cemented reservoir), a prerogative of landowners versus tenants. Farmers also needed to have the means to invest in vegetable gardening (pump ownership served as a proxy for investment capacity and was a guarantee that farmers had access to water).
11. In February 2014, a monitoring and evaluation study conducted by an iDE consultant evaluated that iDE had 104 individual clients (using 213 kits) and that the corresponding drip kits covered 4 hectares only. In January 2015, iDE had sold 650 kits to farmers.

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