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THE CONUNDRUM OF LOW COST DRIP IRRIGATION IN BURKINA FASO: WHY DEVELOPMENT INTERVENTIONS THAT HAVE LITTLE TO SHOW FOR CONTINUE

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Abstract

Through a case study in Burkina Faso, this paper interrogates the persistence of development projects that promote low cost drip irrigation even though the prophesized widespread adoption of this technology by smallholders in sub-Saharan Africa has remained elusive until now. The enduring image of “drip kits” as effective tools to alleviate poverty in an environmentally sound way is the result of the active efforts of a tight network of enthusiastic research and development actors. Rather than “field evidence”, what sustains development projects promoting drip kits is a skillfully framed interpretation of what these could achieve (their potential) and a lack of downward accountability of the international development sector.

Introduction

Research and development efforts concerning drip irrigation have traditionally been oriented towards intensive commercial farming in developed economies, focusing on ways to improve efficiencies and productivities. From the mid 1990s onwards, an increasing number of research institutes and non-governmental organizations (NGOs) have engaged in efforts to make drip irrigation also accessible to smallholder farmers in developing countries. This entailed attempts to design much smaller drip systems, which would be cheaper and easier to operate than the high-tech systems used by farmers in developed economies. These systems would quickly become to be known under the generic term of “drip kits”; they operate under low pressure to provide localized irrigation to small plots, with sizes extending from a few square meters to a few hundred square meters. Apart from the water reservoir (tank), “kits” come in pre-packaged plastic bags (smaller kits) or carton boxes (larger kits) (see Chapter 11, this volume and Box 1).

In the early 2000s, the idea of making a modern technology suitable for use by poor smallholder farmers acquired wide resonance among a diverse group of actors working in the fields of agriculture, water governance, irrigation, and more generally the environment and development (Cornish, 1998; Kay, 2001; Polak et al., 1997; Postel et al., 2001). Smallholder drip irrigation has now become one among a number of popular ‘development technologies’, promoted by many organisations that aim to improve smallholder farming in the South. Yet, use of drip kits outside of development projects arena remains at best sketchy (Chapter 14, this volume).

What we find remarkable, and will attempt to explain in this chapter, is that the absence of sustained drip kits use by farmers did little to temper the enthusiasm of their promoters, and has not dented the reputation of the technology as a promising development device. It seems that when one project ends, a new one is implemented to promote and disseminate drip kits, even when evidence of use by farmers is lacking. We use the rest of the paper to provide an explanation of why development actors continue promoting drip kits even when there is little empirical evidence to support the belief that, indeed, they deliver on the promises of poverty alleviation at household, national and continental scale.

Our objective here is not to dismiss a specific technological package, the “drip kit”, nor is it to analyse why smallholder farmers are not interested in the kits (Dittoh et al., 2013; Friedlander et al., 2013 as well as Kulecho and Weatherhead, 2015, 2016 provide insightful analysis on the constraints smallholder face to use such kits), nor do we aim to compare how different dissemination approaches (for instance handing them out for free versus having farmers pay for them) influence rates of adoption and sustained use. Instead, we use our analysis of projects promoting drip kits to shed light on the workings of development cooperation, considering our case as symptomatic for the sector whereby “development projects” have many flaws including short time line and a lack of quality supervision and follow up.

In the section that follows, we start by describing the enthusiasm for drip kits in Burkina Faso and our elusive search to find these in farmers’ fields. We then describe the analytical framework that has guided our analysis and the methodology used. The third section identifies the five pillars upon which development actors rely to bring into being and indeed perform “drip kits” as a success. A short conclusion summarizes our main finding, which is that drip irrigation in Burkina Faso is an exemplary case of how development cooperation works: rather than experiences of use by farmers, its success is the result of the active story-telling, designing and staging interventions, analysing and reporting by the parties promoting drip irrigation.

Box 1. An insider quarrel: which drip kits are best?

Broadly speaking, two types of smallholder drip irrigation systems (also called ‘drip-kits’) can be identified. The first type of system, designed and marketed by large drip irrigation equipment companies such as NETAFIM and NaanDan-Jain, are “classic” drip irrigation systems that have been “down-sized” to fit smallholder plots (the Family Drip System –FDS- of NETAFIM was, for instance, originally designed to cover a square plot of 500 m² but can be adapted to variable plot sizes). These systems are made of relatively advanced components such as in-line drippers that require good water filtration and a minimum water pressure of 0.3 bars (Kay, 2001). Though they are widely seen as being the best quality low cost drip irrigation systems on the market, they are also criticized for being difficult to operate for smallholders and rather expensive. The second type of systems is the drip kits promoted by NGOs and social enterprises. These kits are often manufactured by small companies in India and China and are the results of a quest to decrease manufacturing costs and improve the ease of use (Polak, 2008). They are made of cheaper (and often more fragile) plastic pipes, use micro-tubes as emitters (so as to avoid clogging) and can be adjusted to plots as small as 20 to 100m² (though they are most often promoted in a range of size going from 250 to 1,000 m²). Regardless of the system, debates among insiders reveal that each of the two options has specific requirements for use, their advantages and drawbacks.¹

Early enthusiasm, a wealth of projects and illusive drip kits

In the late 1990s and early 2000s, several books intended for a wide audience (Polak, 2008; Postel, 1999) and specialized publications (Polak et al., 1997, Postel et al., 2001) voiced enthusiasm for smallholder drip irrigation systems, often on the basis of a limited number of experiments conducted in South-Asia. These publications highlighted that smallholder drip irrigation offered the prospect to save labour and water, while improving yields and food security, as well as boosting incomes at household level. This was followed by a series of projects implemented by different consortiums (funded by different organizations) in different regions of the world during the 2000s.² In the early 2010s, a new series of publications reporting on some of the major development projects that had been conducted in sub-Saharan Africa voiced the same enthusiasm regarding the prospects offered by low cost drip irrigation for smallholders (Burney et al., 2010; Burney and Naylor, 2012; Woltering et al., 2011a, 2011b).

These publications reflected a shared eagerness to test and promote low cost drip irrigation system in developing countries among research institutes, development agencies, NGOs, and national governments alike, who widely advertised the successful dissemination of thousands of drip kits to smallholders in sub-Saharan Africa (for instance, Abric et al., 2011; ICRISAT, 2005; Kabutha et al., 2000). Burkina Faso is no exception to this trend and from 2004 to 2015, there were no less than eight projects aimed at promoting smallholder drip irrigation in the country (Table 1). At the time of conducting field work for this research (2011-2014), enthusiasm for

smallholder drip irrigation in Burkina Faso was high, with several ongoing projects and others starting. We interpret this multiplication of projects as testimony of a continued belief in and enthusiasm for drip irrigation as a promising development technology, and also take it to mean that previous dissemination efforts were held as successful (or at least promising).

Table 1. List of drip irrigation projects initiated since 2004 in Burkina Faso

	Dates	Project Name	Funding agencies	Main implementing agencies
1	2004-2007	African Market Garden (AMG)	USAID/ Africare/ Swiss Development Cooperation (SDC)	ICRISAT, INERA
2	2007-2010	Approche Intégrée pour le Développement de la Maraîcherculture (AIDEM)	Swiss Development Cooperation (SDC), Burkina Faso Office (BuCo)	Optima Conseils Services (OCS), GEDES
3	2008-2012	Drip irrigation promotion	IFAD	IFDC
4	2008-2014	Projet d'Irrigation et de Gestion de l'Eau à Petite Echelle (PIGEPE)	IFAD & Government of Burkina Faso	Ministry of Agriculture (MAHRH)
5	2009-2012	Enhanced Homestead Food Production	USAID	Helen Keller International (HKI)
6	2010-2014	Programme de Développement du Maraichage par l'Irrigation Goutte à goutte (PDMIG)	BuCo/SDC	GEDES, OCS, CSRS, Kali Service
7	2012-2013	Water use and sustainability in market gardening in Burkina Faso	Self Help Africa (SHA)	SHA, ADECCOL NGO, and iDE
8	2011-2015	Scaling Up Micro Irrigation (SUMIT)	SDC	iDE

Source: The authors, 2015

Our own observations and a review of the few studies documenting efforts to disseminate drip irrigation to smallholders, however, provided little support for such enthusiasm. When we first ventured into the field – nearly 10 years after the first projects promoting drip irrigation in Burkina Faso had started- we had actually difficulties to locate sites in which drip irrigation had been promoted in the past. There seemed to be little institutional history of drip irrigation

projects. As far as ongoing projects were concerned, the sites we were told to visit appeared to be demonstration plots, in which farmers used drip kits with significant external support. With the help of individuals that had been involved in projects promoting drip irrigation in Burkina Faso over the last decade, the first author of this article identified and visited all the 87 project sites he could identify and in which drip kits had been promoted. Out of these 87 sites, drip kits were in use in 28; these were sites of on-going projects. All other sites had once seen drip kits (maybe) but farmers had stopped using them as soon as projects ended and no sign of it could be found (Wanvoeke et al., 2016). For instance, of the several hundreds of farmers that were said to have benefitted from the African Market Garden Project (AMG), we could only identify one who had continued using drip irrigation after the project ended in 2007 (see Wanvoeke et al., 2015b for a detailed description of the history and results of the AMG project). Likewise, in February 2015, just after the *Programme de Développement du Maraichage par l'Irrigation Goutte à Goutte* (PDMIG) ended in December 2014, none of the 15 demonstration sites that the NGO implementing the project had said to have set up seemed to be in use. At the peak of the vegetable gardening season, fields were idle, with drip lines lying in messy heaps in the corners of the fields. As for the PIGEPE project, the main government initiative promoting drip irrigation at the time of the study, field visits indeed revealed drip lines dotting the landscape (in 2012, 488 kits out of the 15,000 originally envisioned in 2006 had been disseminated to farmers).³ Yet, although farmers had left them in the fields, they preferred using watering cans and hoses to irrigate their plots (see picture 13 in colour plate). These observations confirm what other scholars have said about the difficulties faced by smallholders to use drip kits and their rapid abandonment once the projects end for instance in Kenya and Zimbabwe (Belder et al., 2007; Kulecho and Weatherhead, 2005; chapter 14, this volume).

Theories and methodology

Within the broad discipline of the anthropology of development, there is a tradition of work that investigates the narratives and practices of development projects and aims at explaining how projects come to be seen as failures or successes (Mowles, 2010; Olivier de Sardan, 2005; Rottenburg, 2009; van Assche et al., 2012). For our analysis, we notably draw on Mosse (2005). His argument is that writings about development projects outcomes do not merely report a reality that is 'out-there', but instead actively construct and even help perform it. Projects realities thus come into being "through the interpretive work of experts who discern meaning from events by connecting them to policy ideas, texts, log frames, and project documents" (Mosse, 2005, p. 157). According to Mosse, "development success is not merely a question of measures of performance, it is also about how particular interpretations are made and sustained socially. It is not just about what a project does, but also how and to whom it speaks, [and] who can be made to believe in it" (Mosse, 2005, p158). In the same vein, and adopting a Science and Technology Study perspective, development projects can be seen as arenas, or knowledge infrastructures in

which realities are generated through the production of specific data, results, outcomes, and are interpreted through specific indicators by actors coming from specific networks.

We make use of these ideas for analyzing the travels and travails of smallholder drip irrigation. They turn the analytical attention to how a technology such as drip irrigation is made “successful” through the efforts (reports, information, data, interpretations, stories) of the coalition of development practitioners, funding agencies, scientists and policymakers who are involved in its design, testing, promotion and dissemination. Together these efforts help bring a specific smallholder drip irrigation reality into being, one in which the technology figures as something promising, even though it is little used by farmers themselves. We have identified 5 specific ways through which this happens: (1) fitting smallholders to the technology; (2) demonstrating success through the use of experimental plots and pilot farmers; (3) highlighting results ‘at scale’ through specific metrics; (4) aligning the technology to broader development narratives; and (5) creating a network of actors supporting the dissemination of the technology. We further describe these in the following sections.

We base our analysis on a broad literature review of past experiences with and current trends in the promotion and dissemination of drip kits in developing countries, and on an in-depth analysis of the grey literature (project documents, reports, web-based information) of projects implemented in Burkina Faso. This yielded a comprehensive list of all actors involved in the sector in Burkina Faso, most of whom we contacted for interviews and discussions. In addition, we conducted field work in Burkina Faso, in four phases. First, from June 2011 to November 2012 we interviewed 44 agents 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 of the 87 drip irrigation projects’ sites we had identified through these interviews. Through these visits, we aimed at gaining a better understanding of the implementation modalities of drip irrigation projects and of drip irrigation-in-use. Third and during the same period (November 2012 to November 2013), we selected three projects (PIGEPE, SUMIT, and PDMIG) for more detailed cases studies. We also used this period for additional interviews with staff and partners, visits to projects sites and for participatory observations during project events (promotional campaigns). Fourth, in February 2015, and after some of our initial critical conclusions had raised questions among the organisations promoting drip irrigation in Burkina Faso, we conducted a short visit to assess how the situation had evolved in some of the sites we had previously visited and documented.⁴

Beyond events: staging interpretations, performing realities

Fitting smallholders to the technology

The engineers working to re-design and re-adjust drip irrigation to smallholder farmers needs were genuinely committed to helping solve problems of poverty and hunger. They were however, guided by (largely untested) assumptions about smallholder farmers. These were thought to be poor, un-educated, technologically unskilled, and to have (very) small (square) plots in which they wanted to grow vegetables. Hence, the systems were to be low-cost, requiring a low initial capital investment⁵, function at low pressure (to decrease energy cost), whereas they were also designed and tested in the form of ready-made kits for ease of operation and maintenance as smallholders, it was considered, lack the necessary know-how to operate drip systems (Cornish, 1998; Keller and Keller, 2003). An additional requirement that guided the design of such system was that it had to be readily reproducible in a variety of regions (Polak, 2008), preferably with locally available material and by local artisans or manufacturers.

The design principles may appear to be sound, but perhaps more than referring to any living rural person in Africa, the poor farmer for whom drip kits were designed exists above all as the iconic rural development client that justifies the existence of aid organizations and donors. We do not want to make any claim about whether or not this client really exists (poor farmers are indeed in the millions); our point is that the story of a poor farmer as the grateful recipient of a simple and appropriate irrigation technology was, and is, a very attractive one to market to a donor audience. In this respect, it is telling that almost irrespective of where drip kits are disseminated, very similar documentaries and short press articles with photos appear that tell strikingly comparable stories of how drip kits were the stepping stone to help a particular poor farmer family escape poverty (for a particularly striking video see the “personal story” of the first CEO of iDE-India in the *Uncommon Heroes* film series of the Skoll foundation; (<http://www.skollfoundation.org/approach/uncommon-heroes/>). Against the near absence of any farmer actually using smallholder drip systems in their fields, the continued persistence and production of such stories is ironic.

In Actor-Network terms, one could say that in the process of designing the “appropriate” technology, also an appropriate user was invented: the small, poor farmer nevertheless capable of making good use of this technology with proper training. An even more appropriate user is the woman farmer responsible for household management, hard working and more entrepreneurial than her male counterpart, and whose workload needs to be diminished so that she can take care of her other chores. What is problematic here is not to say that poor farmers exist, it is the tendency to standardize smallholders the same way drip kits have been standardized, giving the illusion that a unique technology can meet the needs of all smallholders alike, independently of their specific situation. The configuration of the user, though, is key to sustain the appeal of drip kits: the existence of this much advertised “iconic farmer” who realizes the benefits of drip kits also provides a way to explain why certain projects “fail” and to call for further funding: this is because smallholders fall short of the icon and need to be further helped. This iconic farmer often operates in specific places: the experimental plots, which also play a key role in sustaining the positive imagery of drip kits as described below.

Performing success through experimental plots and pilot farmers

One oft-used strategy to demonstrate the success of drip kits is to literally “create the context/conditions” for these to be effective and successful through the establishment of experimental plots involving 'pilot' farmers. Dedicated field extension agents actively support these farmers during the project implementation phase, helping them become the entrepreneurs of development narratives and project documents, in other words the “public face” of drip irrigation (see Wanvoeke et al., 2016 for a description of one of these public face farmers).

There, researchers and development agents use the realities that they themselves actively helped construct to stage the promises of drip kits, which are then reported in scientific publications or dramatized and staged in promotional campaigns. Our argument here is not that it is wrong to run pilot sites and demonstration plots. We want to show how these crucially figure in the dramatic staging of particular approaches or technologies – in our case drip irrigation kits – as successful. Importantly, thanks to the heavy financial and human investment, experimental sites look attractive and well-organized: because they literally perform the reality that projects strive after, they function as bill boards to advertise the success of the projects as well as of the technology. Just as many other development projects do in sub Saharan Africa, projects promoting low cost drip irrigation like bringing outside visitors and potential donors to these sites, using them as successful examples of what drip irrigation can help achieve. In the near absence of use of drip kits by farmers, outside of any development arenas, this vision often becomes the only drip irrigation reality that is being portrayed.

This specific drip reality performed on experimental sites by pilot farmers is also the one against which what is happening in farmers' field is assessed. Hence if results obtained in real-world (uncontrolled) conditions are disappointing, this tends to be interpreted as a failure of farmers or, in some instances, as a failure of projects to provide an adequate follow up, never a failure of the technology. But even those results would not be enough to explain the attention that drip irrigation kits has received without a strategy highlighting that drip kits could achieve change ‘at scale’; this is when specific metrics come into the picture.

Highlighting “results at scale” through specific metrics

A common way to establish and perform low-cost drip irrigation as a positive and effective development technology is to choose specific indicators for measuring success. All drip irrigation projects in Burkina Faso used the number of kits disseminated and/or the number of farmers trained as their primary measure of success (see table 2). In most cases, as for many development projects, these numbers are self-generated and not checked by any independent organization, or backed up by feed-back from users. If kits are said to have been sold (as opposed to given away), this is meant to be further proof of their potential: which poor farmer would indeed purchase a drip kit if s/he had not identified its value and was not planning on using it. Yet, and irrespective of formal philosophies, the mode of operation of most projects is

that the vast majority of drip kits are sold to other development agents (NGO's, government agencies) as opposed to directly to individual farmers (Venot, 2016). These agents then disseminate the kits to farmers, often heavily subsidized or for free, as part of their development projects. Indeed, direct purchase by farmers is rare. For example, iDE reported that since 2012 they sold 4000 drip kits in Burkina Faso. Of these, 85% was sold to 'institutional clients', that is, development organisations who conduct their own drip irrigation promotion.

Table 2. The metrics of success of different drip irrigation projects in Burkina Faso

Projects names	Metrics of success
1. African Market Garden (AMG)	2000 FDS type kits distributed among farmers (500 in Burkina)
2. Approche Intégrée pour le Développement de la Maraîchiculture (AIDEM)	- 14 drip sites installed - 28 drip kits of 500m ² distributed
3. Drip irrigation promotion (IFAD Grant)	- 60 kits of 10 m ²
4. Projet d'Irrigation et de Gestion de l'Eau à Petite Echelle (PIGEPE)	- 4200 kits are acquired - 1200 kits are disseminated
5. Enhanced Homestead Food Production	- 300 drip kit of 20 m ² installed
6. Programme de Développement du Maraichage par l'Irrigation Goutte à goutte (PDMIG)	- 15 drip sites installed - 30 kits of 500m ² distributed - 450 farmers trained - 60 000 farmers have visited the pilot sites - 3450 farmers have adopted drip kits
7. Water use and sustainability in market gardening in Burkina Faso	- 7 gardens for drip are installed - 21 kits of 500 m ² and 7 kits of 100 m ² distributed
8. Scaling Up Micro Irrigation(SUMIT)	- 4000 kits of different sizes are sold

Source: Authors, 2015 (Data collected from projects reports) Using the number of drip kits sold or disseminated as the prime indicator of their effectiveness is, in other words, yet another way to help bring about or perform the reality of development cooperation actors, a reality in which low-cost drip irrigation is what farmers need and want (as they accept or buy them), which is why it is worthwhile to continue financing its promotion.

Aligning the technology with development buzzwords

Beyond pilot farmers and metrics such as the number of kits sold or distributed, it is the ability of drip kits to lend themselves to multiple development buzzwords and development narratives that also explain why and how smallholder drip irrigation has become to be seen as a successful development device. In other words, drip kits are “successful” because they hold the promises of addressing some of the most pressing challenges facing the African farmer.

Smallholder drip irrigation has, right from the start, been discussed in relation to its potential to alleviate hunger and poverty (Bala, 2003; Postel et al., 2001) and to enhance food security (Burney et al., 2010; Lewis, 2010). This is because drip irrigation has been promoted as a way to boost vegetable production during the dry season, leading to improving nutrition through self consumption and improving revenues through sales. Results from experimental plots obtained as part of cross-country international research projects have been central to legitimize these promises (see for instance Pasternak et al., 2006 and Woltering et al., 2011a).

In addition to poverty alleviation and food security, drip irrigation has also been discussed in relation to gender equity and women empowerment that are high on national and international development agenda. The drip kit discourse indeed highlights the small size of the kits and their ease of operation, which make them “particularly suitable” to women who are said to face particularly acute constraints in terms of means of investments and access to land (on the constraints women face to access land, see notably van Koppen, 2000). Given their size and mobility, it is indeed said that these kits can be installed virtually anywhere and do not require secure land access per se. The ‘investment barrier’ is, on the other hand, often lifted through micro-credit schemes that are also a favourite *modus-operandi* of development actors to help women to be independent. This suitability of the kits for women is reinforced by the fact that they are mostly used for vegetable production and home gardening, seen as a “feminine” component of African farming systems (Dittoh et al., 2013).

A third discursive dimension which plays out in the background relates to the preservation of natural resources. Drip kits share enough commonalities with their “hi-tech brother” promoted in developed countries to be associated with relatively high water use efficiency. This lends them an aura of “greenness” and “efficiency” that makes them attractive to many development actors. These indeed have to juggle with two overwhelming narratives, the imperative needs for speeding up irrigation development (which is said to lag behind that of all other continents) in a context of little availability and high unreliability of water, and for curbing sub-Saharan African environmental degradation (for a critique of the latter see Keeley and Scoones, 2003).

Finally, what has made drip kits attractive over recent years is its close association with a notion that is gaining importance in the international development sector, that of “entrepreneurship”. The entrepreneurship narrative plays at two distinct levels as far as drip kits are concerned, the level of the organisation promoting the drip kits and the level of the farmer. At the level of the organisation, widespread disappointment with development *aid* has led many actors to call for more private sector involvement and for mainstreaming a ‘business approach’ to development

and public policy (see, for instance Chapter 18 for a study of a privately-led mechanism of managing public policy in the state of Gujarat, India). This notably translated in the multiplications of “social enterprises”, that is, organisations aiming at making a profit while pursuing a social or environmental goal. These have come to be widely seen as alternatives to ‘traditional’ development agencies and big businesses (see Venot, 2016 for a discussion on social enterprises and drip irrigation). In the field of drip irrigation, international Development Enterprises (iDE), maybe the most well know advocate of drip kits, falls in this category and strongly communicates about its “business approach to poverty” (for instance Polak, 2008; see also box 2). iDE for instance insists that it sells drip kits, rather than giving them away; the story then goes that if sold, it means the drip kits are bought by farmers hence that they are needed, which lends them legitimacy (for a critique of this narrative, see Venot, 2016). For social enterprises, and the powerful private foundations who support them (including financially), African farmers are not anymore the mere beneficiaries of “hands-out” but rather “clients” free to choose whether or not they want to buy a particular product. At the level of the farmer, drip kits –because they need to be purchased and allow for market-oriented vegetable gardening- are the means through which poor smallholder farmers, with adequate support and tools, will evolve into and successful profit-making rural entrepreneurs.

Box 2: The start of a business approach: Low-cost drip irrigation promotion in Nepal

Nepal (together with India) is one of the first countries in which drip kits have been tested; the approach used there by iDE in the mid 1990s has strongly inspired their later operations in other countries. In 1994, iDE signed an agreement with the Agricultural Development Bank of Nepal to promote small-scale drip systems (Upadhyay, 2004) and started developing its first kits in 1995 to irrigated home gardens. The particularity of these kits is that they are made of PVC, rather than polyethylene like in other countries; this is because PVC was readily available in Nepal and iDE wanted to source equipment locally as much as possible.

Right from the start, iDE did not solely envision the promotion of drip kits; they aimed at establishing a supply chain for (1) the drip irrigation equipment but also for (2) the agricultural (vegetable) products. They notably supported the establishment of a drip irrigation equipment factory in Kathmandu and set up small market centres, This happened through collaboration with Winrock International and the USAID-funded Smallholder Irrigation Market Initiative and its Commercial Pocket Approach. In practice, this meant that drip kits were mostly promoted and installed in areas that were deemed favourable for commercial farming activities, including having a reliable source of water and being close to roads and market centres. Starting in 2003, Vegetable Collection Centres, which are meant to function as entrepreneurial cooperatives and trading centres for up to 300 smallholders, have been set up and Community Business Facilitators, partly paid on the basis of commission, (now dubbed Farm Business Advisors in some iDE operations in sub-Saharan Africa) identified to facilitate marketing of both agricultural inputs and outputs.

Another key element of iDE operations in Nepal, which partly explains the large number of kits that have been disseminated there, is the early association of drip kits with a new type of rural water supply known as Multiple Use Systems (MUS), which was and still is strongly supported by Winrock and the International Water Management Institute. The idea is to design rural water supply systems so that both domestic and productive water needs can be met, but through separate pipe systems. Such a design, in the idea, enables households to meet water needs for domestic purposes first (using household outlets), and then to make more risky, market decisions per household on the use of water for commercial purposes (using productive outlets) (see picture 12 in the color plate). Recently, the commitment to purchase drip kits has often been a prerequisite for communities to benefit from a MUS system that also provides water for domestic purposes.

In spite of IDE's enduring commitment to promote low-cost drip irrigation in Nepal, the rate of adoption among smallholders has been very low. By 2015, approximately 250 MUS systems had been installed by IDE at the village level, but not all smallholders in these systems opt for using drip irrigation, and many abandon the kits after two or three years of use (Clement *et al.*, 2015). Reasons are that low-cost drip systems are still too expensive for many smallholders, especially because the gains of vegetable gardening are not that high, and that alternatives for home garden irrigation are cheap and readily available, for instance, through hand watering, or by using a bucket or hose of the MUS system for irrigation (von Westarp *et al.*, 2004, Liebrand, 2015). In this regard, the promotion of low-cost drip kits in Nepal by IDE is emblematic of a technical intervention that does not travel outside the boundaries of the project development arenas.

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Creating a supportive coalition

The above stories in which smallholder drip irrigation figures as a successful device to help meet a large range of development objectives are not free-floating tales. They are actively produced, articulated and circulated by the individuals and organisations involved in promoting and disseminating drip kits. Their existence in turn, influences what happens in projects: the narratives and the ideas that they contain are connected, circulated and indeed made true through networks of people, flows of money and equipment (Mosse, 2005).

Our research shows that since 2004, when the first drip kits were introduced in Burkina Faso by two research centres (ICRISAT and its national partner INERA) in the framework of the AMG research for development project (see Wanvoeke *et al.*, 2015b), the network of actors promoting this technological package has significantly extended, further framing the technology as a success in what may appear as a self-predicating prophecy. After all, if renowned organizations, acting for the right reasons, promote a modern technology, it can only be positive.

Figure 1. The actor-network supporting the promotion of drip irrigation in Burkina Faso (The authors)

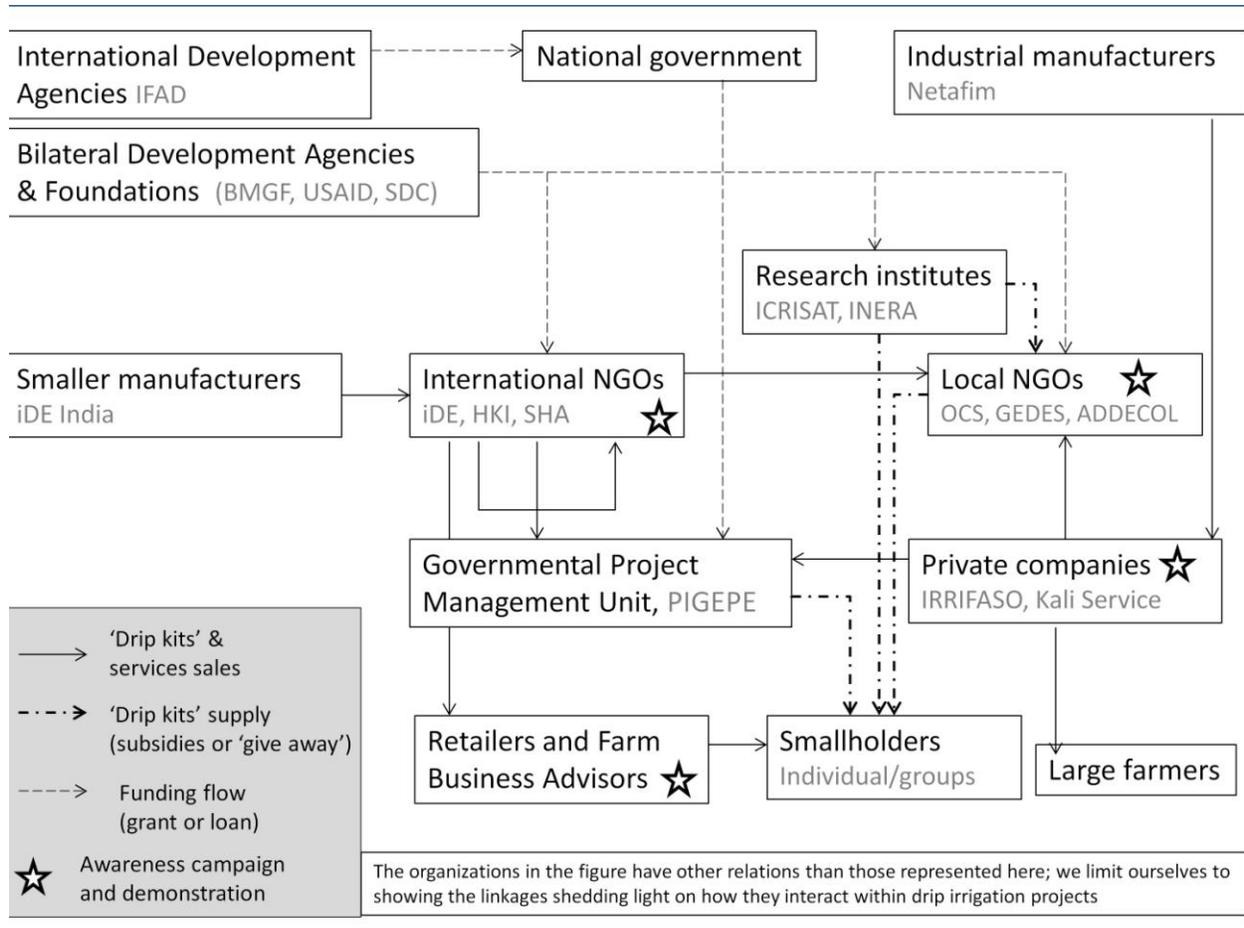


Figure 1 highlights the far-reaching nature of the actor-network at play around drip irrigation promotion in Sub-Saharan Africa, and Burkina Faso more specifically. It now includes several funding agencies, international and national NGOs, research organizations, private companies and small-scale entrepreneurs as well as the national government (figure 1). These actors are closely connected to each other through the different smallholder drip projects that have been implemented in the country over the last ten years. The coalition started “small” but with “big international players” brought together by an Israeli scientist: the World Bank, Netafim, ICRISAT (and later SDC and USAID) got together to promote drip kits and vegetable gardening in the framework of the AMG project, whose results were published in scientific journals and widely advertised (see above). INERA, the Burkinabè national research institute was in charge of implementing the project in Burkina Faso (see Wanvoeke et al., 2015b for a detailed description of the genesis and history of the AMG project). A bit later and surfing on the massive support

they had received from the Bill and Melinda Gates foundation in the late 2000s, iDE was looking to extend its operation in sub-Saharan Africa. It opened an office in Burkina Faso in 2011 with the support of one of its historical partners, the Swiss Development Cooperation (SDC), and quickly extended its collaborations with other actors that were also looking at promoting drip irrigation (notably IFAD). This largely happened on the basis of prior professional and personal relationships between individuals working for different organizations.

At present, the drip irrigation coalition counts “international players” that give a global resonance to drip irrigation projects implemented in Burkina Faso. These are international aid agencies, private foundations or large private businesses involved in manufacturing and selling drip irrigation equipment worldwide. International aid agencies and private foundations are all too happy to jump on the bandwagon of funding a new technology often presented as a “silver bullet” and that has acquired a scientific and technical legitimacy through the involvement of renowned engineers, development practitioners and researchers alike. By funding programs that promote low cost drip irrigation, these international institutions largely contribute to shaping the positive connotation that surrounds low cost drip irrigation. For large private companies (such as NETAFIM and Jain Irrigation Inc.), drip kits are a means to make tangible their corporate social responsibility rhetoric and policy (alleviating poverty while preserving natural resources). It is also a way to enter and tap new markets, whose actual dimension still remains to be assessed but has come to be seen as a potential Eldorado (see for instance, Prahalad and Hart, 2002).

At a more local level, the “reality” of drip kits is also defined by the multiple actors involved in project implementation. As far as these are concerned, several main categories of actors can be identified (figure 1). First, research institutes that are focused on demonstrating the suitability and performance of drip irrigation through pilot studies; they play a key role by building the (scientific and technical) legitimacy of drip kits as a “development technology” and were among the first to promote drip kits. Second, national and international NGOs as well as government-managed projects who, by using specific metrics and staging the potential of low cost drip irrigation (see above), “demonstrate” that results can be achieved at scale hence attract the attention of potential funders. In some instances, these also “refine” the technological package providing another alternative reality: that of a technology that is standard enough to have widespread impact but adjustable to context, making it “locally relevant”. Third, private companies and consulting firms who by retailing equipments and/or providing services on the design and use of drip irrigation systems contribute to giving an image of a vibrant sector that takes the form of farm business retailers and small rural business (still largely dependent on funds from development organizations) at the most local scale (i.e. in the vicinity of the pilot sites established by NGOs and other development actors). Finally, as stated above, farmers (male/female) using drip irrigation (be they small or large-scale farmers) provide the “iconic model” of the entrepreneur that is sought after by many in the development cooperation sector.

The precise terms about which these actors engage with smallholder drip irrigation may differ, but their stories and projects are nevertheless compatible and complementary (see table 2). Because all actors largely depend on finance provided by international development agencies, and are closely connected through personal relationships, flows of funds, equipment and staff, they are accountable to each other and united in their desire to bring smallholder drip irrigation into being as a successful and effective development tool, in the process also actively creating the context through and in which this becomes true.

Conclusion

Development agencies, NGOs and government actors have been instrumental in presenting smallholder drip irrigation as a promising technology that has the potential to boost incomes and improve food security. The technology figures in multiple development efforts as a tool to alleviate poverty. In Burkina Faso, and more generally in sub-Saharan Africa, these development efforts that started almost two decades ago have not led to the wide-spread use of drip irrigation by smallholders that was prophesized and hoped for. Indeed, the use of smallholder drip irrigation is not spreading beyond the experimental settings in which development interventions take place. Remarkably, this has done little to temper enthusiasm regarding the technology among development agents and funding agencies, which still (want to) believe in its promises.

This paper is an attempt to provide an explanation to this conundrum: why, after almost two decades of efforts that have yielded little, do many actors in the sector continue to speak of smallholder drip irrigation and drip kits in particular in such an enthusiastic way? We do so, by turning our attention away from the technical characteristics (and potentialities) of the technology per se towards the actor-network in and through which it is being enacted.

We show that the positive imagery associated with smallholder drip irrigation is the result of conscious and carefully crafted strategies by development actors, united in a supportive coalition (the first pillar of the discursive success of drip kits). This positive imagery also rests on four other key features. First is the ‘engineering soundness’ of drip irrigation that several contributions in this volume question (i.e. the largely advertised fact that drip irrigation leads to productive and efficient use of water). Second is the careful selection of indicators against which the success of drip irrigation projects is measured: experimental results on yields and revenues and number of kits disseminated, which say little on how farmers perceive and may use drip irrigation kits. Third, the discursive success of smallholder drip irrigation is also linked to a specific vision of African smallholders (small, poor, nevertheless capable of making good use of a technology to grow crops for the market given appropriate training). Finally, the positive connotations of drip kits hinges on the ability that actors in a wide-reaching supportive coalition have to strategically present them in relation to dominant environmental and development discourses. By doing so smallholder drip irrigation becomes an option to solve grand challenges, which makes it attractive to international funding agencies, but also to the wider public: who

indeed would be against alleviating poverty in an environmentally responsible way? As previously argued by Mosse (2005) in another field and context, it is less the events (in our case, the –limited- extent to which drip kits are used) than the interpretation of the events (the promises of drip irrigation) that matters: shortcomings and failures, instead of discrediting past interventions, call for more as “next time we will do better”.

As such, smallholder drip irrigation, and in particular drip kits, shares many similarities with other development “silver bullets” that attract a lot of attention, in relation to the hopes they give rise to. It is also exemplary of the workings of an international development cooperation that is little accountable to the people it is meant to serve, and largely functions on the basis of short-term projects even though most of the changes it aspires at supporting or triggering are long term trends. What is remarkable – and maybe unique- to drip kits is the in-commensurate attention they have received among development practitioners and researchers (especially at the end of the 2000s when iDE convinced the Bill and Melinda Gates Foundation to support their activities) even though, in relative terms, (investments in) drip irrigation remains marginal when put in the broader perspective of initiatives that support the development of the irrigation sector in sub-Saharan Africa. These indeed remain dominated by rehabilitating and developing large scale irrigation systems. This is partly because drip kits had very skilful spokespersons who, to paraphrase Akrich (1998a, 1998b), created interessement but also because they were both “mainstream” and “alternative” hence could receive the support of a wide reaching coalition. Indeed drip kits could be framed as contributing to a major policy priority of sub-Saharan African countries, that of irrigation development, but with a “twist” as this was predicted to happen on the basis of widespread individual decisions from business-minded farmers rather than through public investment, which have long been maligned for its inefficiency.

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Endnotes

¹ Interestingly, due to a significant decrease in the cost of the equipment proposed by major manufacturers (such as NETAFIM) and because of difficulties to ensure a steady supply of standard quality material from small scale producers, iDE is currently considering partnering with large manufacturers to use their material in their programs.

² Large scale projects include the African Market Garden project (AMG, 2004-2008; see Wanvoeke et al., 2015a for a detailed description) and the Bill and Melinda Gates support to iDE (2007-2010). There were also smaller scale initiatives implemented by NGOs such as Catholic Relief Services, CARE, AVSF, etc. (see chapter 14, this volume)

³ The problems faced to reach the initial targets are largely linked to difficulties (1) regarding procurement and (2) ensuring a steady supply of good quality drip kits. This would lead IFAD, the funding agency, to lower its targets and redefine the project institutional setup (see Wanvoeke et al., 2016 for further details). By 2015, more kits had been “procured” but the end of the project and absence of follow up makes it unclear if these kits have reached farmers, let alone are used.

⁴ The main critic our analysis raised (and still raises) among smallholder drip irrigation proponents in Burkina Faso was that we had mostly documented development initiatives that had finished and were well known among insiders for having been “ill-designed”. On this basis, we hastily dismissed drip irrigation as ill-suited to smallholders in Burkina Faso while we should rather be critical about “the projects”, not about the technology per se. Our point of view is that it is impossible, in the sub-Saharan context, to separate “drip kits” (that would have an inherent ‘potential’) and ‘development projects’ as the former only come into being through the latter. For us, the potential of drip-kits is also defined “through” the development projects that promote them and does not exist “per se”. We were also asked to pay more attention to on-going projects, in which, it was said drip irrigation was successfully adopted on a large scale. This new visit actually confirmed our first assessment, that is, that projects promoting drip kits are mostly discussed and assessed on the basis of what happens in pilot sites, with the prime indicator being the number of kits disseminated even if this does not give any information on whether these are used or not and with which results in farmers fields (see Venot, 2016 and Wanvoeke et al., 2016).

⁵ At most a few hundred dollars, with a basic unit cost at or under 1USD/m², and a plot size under 1000 m².