

Towards Successful Collective Action for Watershed Development for Improved Smallholder Livelihoods in West Africa¹

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Abstract

Livelihoods of many people in Sub-Saharan Africa are tightly depending on sustainable watershed resources. Therefore in several countries, watershed development has become a major issue and many interdependent smallholders with low resource endowments are concerned by the use of associated natural resources. In the particular context of West Africa, watersheds are embedded in complex property right relations among users, making collective or individual investments for their development too risky or too difficult to organize. The diversity of watershed development outcomes, for instance infrastructures like stone bunds and institutions for governing watershed activities are analyzed as public goods and common pool resources (CPRs) using the common theory perspectives. It is well known in the literature that collective action is a necessary condition to resolve problems related to public goods and CPRs in different circumstances. Beyond existing empirical explorations of conditions for collective action, this paper focuses on the design of a pathway to make successful collective action to happen using ideas, concepts and theories of communication, social learning, and management sciences. Insights from watershed projects in Benin, Togo, Mali and Burkina Faso enabled understanding of the (i) nature of watershed development problems, (ii) the learning path for alternative solutions, (iii) external support to implement solutions, and (iv) effects on collective action and smallholders' livelihoods. Key lessons are learnt concerning ways of making watershed problems visible, learning to share a common understanding, and strategies for catalyzing behavioral changes for facilitating the emergence of successful collective action. A synthesis is provided to inform new practices that underpin local institutions building for watershed development that would benefit resource – poor smallholders in West Africa.

Key words: *Watershed, soil fertility, collective action, public goods, livelihoods, West Africa*

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1. Introduction

Natural resources at watershed level are degrading at unprecedented rates in SSA due to many factors including population pressures, overgrazing, and mismanagement of agriculture lands that lead to soil erosion and conflicting uses of the natural resources by various stakeholders (Mando, 1999; Mando *et al.*, 2001). Particularly in West Africa, problems are aggravated with short growing season, unreliable rainfall and frequent dry spells, endemic droughts which have made visible the relation between resource depletion and human hardships and suffering (Falkenmark & Rockström, 2005: 202). The situation explained above comprises the chances of many rural communities in West Africa to meet the millennium challenge goals unless strong measures are taken for watershed development aiming at curtailing further natural resource degradation at watershed scale and at rationally intensifying and diversifying economical and social interventions within the watershed. Pressure on watershed ecosystems may be useful to trigger smallholders to intensify and diversify their agricultural practices and the economies. Given the new challenges such as the actual crises of food production due to persistent land degradation and use of obsolete agricultural tools and practices, and also to the new markets provided by the bio-fuel industries that caused the increase of staple food prices. It has become urgent than ever before to promote sustainable watershed development. Indeed, rice price increases 30% in three months in Burkina Faso and 40% in Ivory Coast (Jeune Afrique No. 2461).

Watershed development involved Soil and Water Conservation (SWC) and soil fertility management technologies such as contour ridging, integrated use of mineral and organic fertilizers, erosion control techniques using vetiver grass and stone bunds. All these innovative options constitute an array of technical and social practices which can be effectively addressed if stakeholders cooperate. Therefore, collective action is needed by interdependent smallholders living in watersheds with low resource endowments to develop for example measures for erosion control and linkages with multiple actors for farm inputs accessibility. Moreover, good governance and institutions set up by smallholders are necessary to perform several functions which cannot be realized at individual levels.

Theories of the Commons (Olson, 1978, Ostrom, 1990) with associated concepts such as human capital and social capital are useful to discuss why is successful collective action a puzzle for watershed development? While many studies have empirically analyzed factors that contribute to collective action, the main assumption of this paper is that a comprehensive learning path based on the adaptation of a framework using social learning theories can be designed to make successful collective action to happen (Westley, 1995; Maarleveld & Dangbégnon, 1999, 2002; Leewis & Pyburn, 2002; Leeuwis, 2004). The paper aims at polling lessons from watershed projects in Benin, Togo, Mali and Burkina Faso to address the main question: what lessons can be learnt for facilitating the emergence of successful collective actions?

The paper explains first the concept of watershed and watershed development and its relevance for the improvement of smallholder livelihoods. Second, a discussion using common theories is done to explain why successful collective action is relevant for watershed development. Third, a pathway towards successful collective action is

discussed using a building block of ideas, concepts and theories to adapt a framework which is used to gain insights from watershed projects in West Africa. Lessons are synthesized with a particular emphasis on emerging ideas, concepts and perspectives to facilitate a successful collective action for a sustainable watershed development and improved smallholder livelihoods.

2. Watershed development and its importance for smallholder livelihoods

Watershed and watershed development

Watershed is defined as an area that drains to a common point. It can cover areas of any size because small watersheds are subsections of large watersheds that themselves can be nested within larger watersheds up to entire river basin (Kerr, 2007). There is a physical linkage between upland and lowlands. The water flows across the soil surface from upper catchments to lower channels. The ability of soil to permit rainfall infiltration and retain moisture tends to be associated with its ability to withstand detachment and transport. The vegetation enables the conservation of soil moisture and the regulation of the hydrological cycles.

Watershed development is differently conceptualized for agricultural development issues in several contexts especially in developing countries (e.g., Doolette et al, 1990; Tiffen & Mortimore, 1992, Ninan, 1998, Joshi *et al.* 2004; Bhatt, 2006; Kerr, 2007). From a technical point of view, watershed development seeks to manage hydrological relationships to optimize ecological services for the conservation and productivity of associated natural resources. Concrete examples concerned local SWC methods which have been documented in Africa (Reij & Scoones, 1999); and Integrated Soil Fertility Management (ISFM) options which combine organic and inorganic for intensified agriculture (IFDC & TSBF-CIAT, 2005). Soft interventions in watershed development can cover several issues as governance, institutional arrangement, knowledge management and sharing, education, advocacy for policy support, etc. The facilitation of learning processes towards successful collective action required a combination of technical (hard) and soft interventions in watershed development.

Relevance of watershed development for smallholder livelihoods

Most of the activities for watershed development primarily target smallholder farmers to improve their livelihoods, in other words, the 'means of living'. The livelihood approach is people-centered, and addresses issues related to poverty of smallholders. A livelihood comprises the capabilities, assets and activities required for a means of living. Hence, it provides a way of visualizing the various components of poverty, their interrelationships and the processes that reinforce it. The assets comprise five capitals (DFID, 2000) which can be adapted to watershed development context:

- Human capital: comprise skills and knowledge regarding issues involve in watershed development.
- Social capital: involves social resources determined by relationships with others. It comprises networks and connectedness to relevant organization to promote watershed development, membership of groups and relationships of trust to ensure good governance for watershed development.

- Financial capital: comprises sources of income and availability of cash, savings, and credit to invest in watershed development.
- Natural capital: comprises quantity and quality of the natural resources associated to watershed and available to people such as land, forests, water, aquatic resources, and biodiversity, etc.
- Physical capital: comprises basic infrastructure, tools and equipment to support watershed development activities.

There are important relations between the capitals and watershed development. In relation to human capital, acquiring knowledge and skills can help intensify agriculture in watershed ecosystems. Financial capital is an essential incentive for investment in watershed development. Natural capital such as grazing land, water bodies, forested areas embedded in watershed ecosystems. As explained above social capital is tied to the analysis of social processes involve in collective action.

We rely on existing literatures and experiences to highlight potential benefits of watershed development for smallholder livelihoods at different levels through:

- Its contribution to agro–ecological diversity (improving natural capital status) to offer several options in agricultural production for smallholder farmers and provide rooms to manage risk in face of climatic uncertainty (Falkenmark & Rockström, 2005).
- Crop diversifications based on the use uplands, sloping ground and lowlands provide by the watersheds architecture if collective investments are made for a sustainable use of land in the watershed ecosystems (cf. also Scoones, 2001).
- An increased cropping intensity using off-season to produce high value crops as the case of the Fadama in the Northern Nigeria where small farmers fence small plot in inland valleys to produce vegetables, potatoes, tomatoes, onion, sugarcane, and rice.
- A tenure arrangement and negotiated access to and use of lands by smallholders to reduce social inequality (Dangbégnon, 2003).
- Perceived incentives by smallholders for entrepreneurship development when these previous condition are realized to increase their agricultural incomes.
- Perceived interdependence in watershed ecosystems which affects change from individual to collective efficacy and ‘new’ networks to facilitate access to farm inputs and credits for ISFM and agricultural intensification. Interdependence is an expression of perceived collective efficacy which means that individual smallholders would judge their staying power, capability and strength to realize that they are individually ‘weak’ and vulnerable (Bandura, 1977 & 1982) to perform some tasks which support their agricultural activities.

3. Why collective action for watershed development?

Watershed development activities can generate key achievements such as contour ridges to control soil erosion in a micro-watershed, rehabilitated gallery forest to improve water availability for small scale irrigation, and functional committees for maintenance. All these outcomes are defined as public goods because of the difficulty of excluding smallholders who did not contribute (excludability issue) to the realization of the outcomes. The well–known theory of collective action of Olson (1978) attributes this phenomenon to a free-rider problem which means the

motivation to enjoy one's share of the benefits without contributing to them. Smallholders in watersheds can benefit from different improvements (contour lines, gullies, outlets for water harvesting, functional rules and norms, etc.) without any provision in terms of money, labour, know-how, innovations, responsibility assignment and credible commitment.

Other achievements of watershed development like catchment's water for irrigation and wood of a rehabilitated forest are defined as Common Pool Resources (CPR) because smallholders will face in this situation the problem of resource flow allocation in a competitive arena (Ostrom, 1990). The resource used by one person will diminish for the others (subtractibility issue). If smallholders have complete freedom, and there is no control over the access of the CPR, 'tragedy' will occur according to Hardin (1968). In concrete terms, catchment's water, woods from rehabilitated forests etc. will need for instance, the rationing of use to ensure equity and social justice. This idea is too simplistic because in real situations, resource users face dilemmas (Dawes, 1980).

Explanations above revealed that public goods and CPRs are associated with watershed development. These two issues are critical for success because discontinuities, disharmony and disputes among strategic groups in watershed development are unavoidable (Bierchenk, 1988) and the conditions under which human cooperation and coordination are realized and maintained depend on contextual factors (North, 1990, Ostrom, 1990, McCay, 2002). For example, smallholders at the downstream of a watershed may complain about the practices of smallholders at upstream and slope ground. Another alternative may be that those who at the downstream level are not keen to contribute to erosion control measures at slope ground level since they can benefit with any contribution. The provision and maintenance problem for the public goods and cooperation required for a sustainable use of CPRs can only be achieved if successful collective action of the smallholders living in their watersheds is effective.

Collective action is applied to various context of human activity (Van Laerhoven & Ostrom, 2007). It is not only the action done together by two or many people in a group; it also means that individual actions are consistent with norms, rules, etc. agreed upon collectively to achieve a 'common goal' (Meinzen-Dick *et al.* 2004). Collective action is conceptualized as a set of communicative practices taking into consideration interactions and engagement of people (Flanagin *et al.*, 2006). It is associated with phenomena in social sciences such as understanding human behavior, social movement, collective choice and connectivity to new social networks (Bimber, *et al.* 2005). A roadmap towards successful collective action is a main issue which needs to be addressed.

4. Designing a pathway towards successful collective action

Having clarified the reasons why successful collective action is a must for watershed development, the challenge is how to make it happened in real situations. Various perspectives in the 'drama of the commons' have shed light empirically into the conditions or design principles under which successful collective action occurs for instance: (i) resource system characteristics, (ii) group characteristics, (iii) institutional

arrangement and (iv) external environment such as innovations, incentives, and conducive policies (see National Research Council, 2002).

While this paper recognizes the relevance of these key variables in the analysis of sustainable management of the commons, an emphasis is put on processes involved in deliberate intervention efforts to generate successful collective action for sustainable watershed development. Taking a constructivist perspective, a pathway towards successful collective action is designed. Constructivist perspectives consider a pluralistic view in science for knowledge generation and constitute a terrain for multidisciplinary approach. Such approach is closed for instance, to the Dutch project in Benin and Ghana in West Africa on the Convergence of Science (CoS) published as a special issue in the International Journal of Agricultural Sustainability (Vol.5 issues 2&3, 2007). The pathway below is our own construction to look at processes involved in interventions of watershed projects with smallholders in the West African context.

Group processes can be facilitated using ideas from soft-system thinking, a way to jointly identify problems regarding watershed development with key smallholders who would perceive their collective benefit (Checkland & Scholes, 1990). An indicator for successful collective action in a real situation is that smallholders change their mind from a strategic way (individual choice) to a more communicative behavior (Brand, 1990): they organize regular meetings, monitor current state of affairs and make collective decision. Our arguments of choosing a constructivist stance enabled us to suggest the following pathway to achieve a successful collective action:

(i) Making problem visible with smallholders in their watersheds

The nature of problem on watershed development depends on the current practices of smallholders and their perception. Intervening parties and smallholders may not have the same understanding on causes. Then, there is the need to adopt an interpretative approach to explain how the problem is perceived and seek for ways to make it visible for all the parties involved.

(ii) Catalyzing a joint learning path with smallholders for alternative options

The learning path can be at different levels, for instance, using different tools to explore technical solutions (e.g. experimentation on soil and water conservation techniques) or social processes to seek for institutional arrangements to clashing interests over resource use and conflicting arenas. An understanding by smallholders themselves of driving learning processes to perceive their interdependence is a key to realize collective action for watershed development.

(iii) Facilitating external supports for the implementation of options

An emphasis can be put on the analysis of communicative intervention strategies used and how effective they are. It is also important to analyze the nature of incentives provided by interventions and their effects for stimulating collective action. How effective are the institutional framework put in place to facilitate a governance of watersheds?

(iv) Assessing the extent to which successful collective action is being achieved

The main objective is to assess if there is evidence that collective action is being achieved and maintained. Contributing factors and key drivers regarding the facilitation of watershed development processes can be synthesized. Finally the assessment can make visible any improvement resulting from watershed development on the smallholder livelihoods

Assuming the relevance of this framework to catalyze successful collective action, can existing watershed projects in West Africa help gain insights to draw robust lessons?

5. Insights on catalyzing collective action from watershed projects in West Africa

Within the ecological diversity of West Africa, watershed projects in Benin, Togo, Mali and Burkina Faso are analyzed following the framework above. The first project focused on institutional innovation to promote soil and water conservation and nutrient management practices; the second reflected a systematic learning process on technological innovations in inland valleys; the third concerned a community mobilization to manage complex watershed ecosystem, and the last highlighted a deliberate effort in a semi-arid ecological zone to seek for ISFM in watershed.

From institutional innovations to collective action in Benin

The problem: shifting cultivation and land degradation

The beginning of 1990s was particularly known as the decennia of large scale natural resource management projects in West Africa. Particularly in Benin, a watershed development project is being implemented since 1992 in the central region of the country with smallholders called Mahi farmers. The watershed development intervention has identified land degradation resulting from shifting cultivation methods of Mahi farmers in their watersheds as major problem. Moreover, unclear property right relations were a constraint in the area characterized by a large number of smallholders (native farmers, migrants, pastoralists) who depend on the watershed resources. Beyond the intervention view on the problem, Mahi farmers perceived runoff in their farms as a serious cause of soil degradation, severe erosion and low yields. Moreover indicators like the scarcity of firewood, the drying up of rivers and water in their wells are used by smallholders to describe watershed problems (Dangbégnon *et al.* 2001).

The learning path toward institutional arrangements

The learning path had three major dimensions: first, identification of existing strategic organisations who would be the relevant actor in a joint learning in watersheds, second, learning about social processes especially in developing grass-root organizations; and third the transfer of competence to adapt technical options in watershed development.

Existing local organizations at village level such as 'Village Development Committee' and 'Village Consultative Council', village associations for agricultural development (especially for cotton) and local saving groups (called *tontine* group) were opportunistically engaged in the exploration of alternative solutions about the watershed problems that were perceived in the area. Concrete solutions were identified with smallholders: contour farming to reduce runoff in the farms, tree planting, regeneration of gallery forests and bush-fire prevention and soil fertility improvement and land registration to reduce tenure conflicts (Dangbégnon *et al.* 2001).

Most of the technical solutions which were negotiated with smallholders, for example contour farming, can only be effective if they are implemented at least at a micro – watershed level (ranging from 2 to 10 ha). Activities like contour farming, tree planting and soil fertility management were organized by committees of functional groups. The functioning of committees for economic activities enabled the emergence of new professional groups like in the nurserymen, beekeepers and horticulturalists. Smallholders developed *Sedoku* metaphor ('our common wealth from nature') to perceive their interdependence through the learning processes. *Sedoku* metaphor captures very well in Mahi language the sustainability issue about a careful use of natural resources which are perceived as the 'wealth' for the present and future generations. The functional committees in different villages were organized in the *Union Inter-villageoise pour la Gestion des Ressources Naturelles* (UIGREN), an inter-village union for watershed development, an apex association at the level of the whole Mahi farmer community (about 13 villages). The roles of the UIGREN were perceived as a local negotiation body and a higher decision making entity for covenants, new norms and regulations for collective watershed development.

External support to maintain various committees to implement options

The Watershed intervention supported smallholder groups by providing incentives in terms of subsidies and credits to adapt contour farming in their farms. The labour cost for setting contour lines were also paid by the project. The cost for improving one hectare was estimated to 37,000 F CFA (1 CFA is approximately 0.0024 \$US) on the average and the contribution of the participating smallholders was 11,500 F CFA. The skills to design contour lines were gradually transferred to farmers through training, and non-formal education. Income generating activities, development of infrastructures (farm equipments, road, watering place, etc.) promoted by the interventions such as income generating were incentives that maintained groups for watershed development activities.

Knowledge management and sharing were organized using different tools such as cultural events, and folk media, exchange visits and farmer day, rural radio program on watershed development issues, training representatives of smallholders in different activities such as tree nursery development, beekeeping. Subsequent interventions on soil fertility management enabled smallholders to experiment different sources of organic matter using cover crops such as *Mucuna*, *Aeschynomenea*, *Stylosanthes* to improve the fertility of soils in their watersheds.

Effects of the intervention on collective action and smallholder livelihoods

Smallholders have changed their way of cultivating in the watersheds. They understood that ridging parallel to water course cause soil erosion and land degradation. Ridging perpendicular to water course became a practice that is internalized. Smallholders realized that their individual actions would not create a major impact on the watershed and that it would be better to adopt collective action and coordinate efforts and join with other villages. For that reason, IUGREN was transformed into a NGO to sustain the actions promoted by the interventions for watershed development.

From induced innovations in inland valleys to collective action in Togo

The problem: soil fertility decline and smallholders suffering

Smallholders living in the Plateau Region of Togo were known as cotton producers. Due to the cotton crisis at the beginning of year 2000, they abandoned it to cultivate soybean for the local market which was not also reliable and secure. Finally, smallholders have moved to the cultivation of cowpea as a key cash crop for the domestic market. Continuous cotton cultivation had led to land degradation and soil fertility decline and low yield for maize at watershed upstream. The intervention of a NGO in the area has perceived the need for smallholders to diversify and intensify agriculture in inland valleys (downstream of watersheds), a potential natural resource which was not used.

The learning path for technological options in inland valleys

Inland valley development is demanding in labor to perform several activities such as land clearing, staking out water course, plotting etc. Smallholders can cope with that as a group. The intervention of the NGO started by mobilizing existing smallholder groups in the villages to jointly learn about inland valley development processes and ISFM options development taking into consideration crops diversification and agricultural intensification. A key emphasis was put on a better understanding of hydrological dynamics of the inland valleys to promote off-season activities. Initially rice was the target crop for the inland valley but smallholders were interested on maize, cowpea and groundnuts. These crops were used since inland valleys conserve humidity and reduce risk of crops failures when dry spells occurred. While a better organization at group level was necessary for smallholders to have access to farm inputs like fertilizers and pesticides, the evolution of their groups in the learning processes was dynamic. Many of them did not understand the action – learning nature of the intervention in inland valley management and abandon the group because they were not happy with the pay-off of their individual action within the group (Folikoué, 2008). The benefits of the pilot activities in three villages (Kèlèkpè, Abègba and Kotchadjo) were differently perceived by smallholders. These benefits also concerned new skills and practices in managing inland valleys for crop diversification and agricultural intensification.

The phenomenon was noticed in Kèlèkpè and Abègba while in Kotchadjo, smallholders realized that their collective efficacy depended on the way of organizing activities. They decided to split their group large with 60 members into 5 sub-groups (8 to 14 members) which came together to create an apex association for inland valley management. The small groups were operational at fields' level and the apex

association dealt with issues regarding the negotiation of credit opportunities and the accessibility to farm inputs with external actors like NGOs, input dealers, and government agricultural services.

External support to maintain groups for innovations in inland valleys

External support involved communicative interventions: exchange visits were systematically organized during the cropping seasons around on-farm experimentation plots jointly designed in the inland valleys. Beside the learning groups, non participating smallholders in the pilot villages, and others from the surrounding villages were invited. Experiences from the fields revealed that these activities were useful when smallholders themselves explained what they have been doing, made a difference between the inputs they used and synthesized what they have learned to their fellows.

Smallholders also faced problems to purchase farm inputs (fertilizers, pesticides). A local solution was to seek for a loan from local merchant and reimburse in kind with cowpea harvest. One bag of fertilizer obtained by the loan was reimbursed by one bag of 100 kg of cowpea which is the double price of the fertilizer. The different groups and the apex association generated by the inland valley development were advised to create a financial asset (membership fees and savings). A support in terms of credits in kind (fertilizer supply) was an incentive that could maintain at a certain stage the groups and the apex association. Small groups operated at activities in the rice fields. The apex ensured collective functions such as the management of credit, the negotiation of intervention in specific areas like technical support, training, such as production of good quality organic matter, toxicity problem in the rice field, well construction to support off-season activities, the introduction of new variety of maize, rice, groundnuts and cowpea.

Are there effects on collective action and smallholder livelihoods?

Smallholders realized that the use of inland valley is a good alternative to improve their livelihoods. They could increase cropping intensity and mitigate drought spells by cultivating in the inland valleys. The interventions have positively affected the human capital and the social capital of smallholders in a short period of intervention see appendix 1. Besides driving forces related to the learning groups as public goods, smallholders realized that the cost of managing inland valleys was high and their collective efficacy depends on the extent to which collective action is being achieved

From community mobilization to collective action in Mali

The problem: perceived risks on the degradation of watershed ecosystems

The southern Mali is very rich in terms of ecological diversity regarding the nature of the natural resource system architecture. Watershed ecosystem involving upstream lands, sloping ground and inland valleys provides a natural capital which is intensively used by smallholders to produce for example rice (by women) and potatoes by men. An intervention project has identified the need to control erosion at the sloping ground to protect the inland valley and to enable a better water infiltration and recharge for use in irrigated rice field. A participatory approach was used to bring smallholders in a collective development of their watershed ecosystem

The learning path for alternative solutions on soil erosion problems

The strategy consisted on the mobilization of farmers to implement activities regarding SWC, especially, installing stone bunds on contour lines and contour ridges after training them. The main objective was to recover soil health at the watershed upstream and to control erosion on sloping ground. This action will enable a better infiltration and a good water recharge to reinforce farmers' activities in the bottom valley (watershed downstream) such as irrigated rice and off – season agricultural activities by the farmers producing potatoes, cowpea and groundnut, tomatoes and vegetables. These activities were conducted in a number of villages in the targeted watershed area. The example highlighted here concerned 8 villages in Southern Mali (Sikasso area).

The mobilization processes started with the negotiation of the intervention with the village chairman and council to join the project activities which would improve their livelihood since their main activities depend on the quality of natural resources. Men and women are involved in agricultural activities in the watershed. Women produced rice in the downstream of the watershed while men produce high value crops such potatoes during off-season. Once the official of the village are convinced, they are invited to organize a general assembly with their people to share understanding on problems perceived and available options for the watershed development project. If the people in the village agree to participate in the project, then a convention for collaboration is developed with the community. Roles and responsibilities are shared between the village and the intervention party. Participatory diagnosis was organized to make visible with smallholders in villages soil erosion problems in their watershed. Participatory village *terroir* mapping exercise was done to locate the areas where erosion control measures would be the most appropriate to generate impact on the watershed ecosystem to support their agricultural activities. These results were shared with the village council for their commitment and approval before any activities on erosion control.

External support for smallholder communities to develop erosion control measures

Most of the villages have already a committee in charge of natural resource management activities, the CVGRN (*Comité Villageois de Gestion des Ressources Naturelles*). The members of this committee and representative of the village's council were trained by the project in soil survey to put in place the soil erosion control measures. Equipments were provided to the trainees (wheel barrows, diggers, etc.). This transfer of competence to the village community was very important to enable them to collectively perform activities. In the communities where the processes of negotiation of the intervention and competence transfer to communities were well understood, the villagers were mobilized to collect stones and constructed stones bunds to control erosion. The monitoring of the collective activities with smallholders has revealed the some concrete benefits for them.

Effects on successful collective action and smallholder livelihoods

Despite the fact that the beginning of these experiences coincided with the raining season, the participatory processes and community mobilization and collective action have generated interesting results, for instance in one of the village, 350 linear meters of stone bunds were constructed to protect about 1000 ha. The community

started observing the effects of the erosion control design such as land recuperation (presence of herbs where there was no vegetation cover). The length of stone bunds established in all the villages after one year activities was estimated to more than 3000 linear meters to protect more than 5,000 ha. Detail survey revealed the recuperation of showed that about 3 ha of land. However beyond collective action at village level, it would be better to organize inter – community visits on the villages where success was effective to enable a large scale diffusion of the SWC practices in the watershed target area.

From ISFM in local setting to collective action in Burkina Faso

The problem: perceived soil fertility decline in drought prone watershed area

The central region of Burkina Faso presents many watersheds which can constitute the natural base for agricultural intensification. A recent government project is intervening to support smallholders through watershed development projects. However, smallholders in this area live in a difficult biophysical condition characterized by poor soil and persistent drought. Uplands consist of degraded soils called *zippele* which can be cultivated after restoration of soil life (recuperation of soil). The farms are very small and their crop yields are low. There is a predominance of subsistence farming. They produce only few crops such as cowpea and groundnuts. Due to low productivity and subsistence orientation, micro-financing structures do not provide credit for the smallholders. Then they have difficult access to farm inputs.

The learning path for technological options with Burkinabe smallholders

Participatory methods such as mapping village *terroir*, transect walk, resource flow mapping, and Venn diagramming (see Pretty *et al.* 1995) are used to generate and share knowledge on local soil resources and cropping systems. Results have revealed that the yields of their major crops (millet, sorghum, cowpea and groundnut) are very low and anything cannot be done if the farmers do not increase the productivity of their land. Smallholders have developed their own strategies to cope with the situation such as the *zaï* technique, the use of half moon technique and stone bunds for soil and water conservation. Researchers and smallholders engaged in a mutual learning process realized joint experimentations using existing local SWC techniques to increase smallholders' farm productivity.

The result of the development of ISFM options for the improvement of sorghum productivity in combination with local SWC techniques (*zaï*, half moon, stone bunds) was successful because sorghum yield using endogenous techniques has increased from 200–400 kg/ha (current local practices) to 1000–1500 kg/ha through improved practices in local conditions (Zougmore & Youl, 2008). Moreover, cowpea yield was improved from 400 kg/ha (average yield in current practices) to approximately 800 kg/ha using micro-dosing fertilizers option in combination local SWC techniques (*zaï* and half moon) on degraded lands (Zougmore & Youl, 2008).

Smallholders have understood that fertilizers can improve the yield of their crops, but they also complained that fertilizers are very expensive. Researchers and extension workers did not have the same frame of reference and cognitive ability to understand and interpret how things were in the same manner compare to smallholder farmers.

For that reason, signs, symbols and conventions developed with farmers were the basis to set up a better way of sharing space for observation, monitoring and learning to generate and use knowledge in a sustainable manner. The discovery of the necessity to invest in their land was an outcome of a joint learning process involving smallholders and project interventions. However this objective would not be possible if functional groups or associations of smallholders were not promoted to facilitate access to various services, credits and farm inputs.

The nature of external support to smallholders

The core support of the ongoing process with smallholders in their watershed should be the promotion farmers' organizations to ensure good governance for the management of credits and farm inputs in a comprehensive mechanism linking them to micro-financing institutions and input dealers associations. The project intervening in the area provided a community investment funds that could be perceived as an incentive for smallholders to form associations or maintain existing ones. Another important issue was the need to initiate by the project interventions start – up subsidies for smallholders to increase crop productivity to ensure food security and the guarantee of credit allocated to them by using for instance a warrantee system. The development of micro-enterprises should increase smallholder farmers' capability to reimburse credits.

However, to achieve all activities, there is a need for the project intervention on watershed development to develop networks with relevant set of actors, build stores and provide various skills development opportunities for all the actors. Private and public service providers should facilitate operations in watershed development and strengthen the capacity of key actors: smallholder associations, dealers, and credit structures. Successes depend on the extent to which those key stakeholders adopt collective actions to provide and support different services for the benefits of smallholder farmers in their watershed development.

6. Lessons for facilitating the emergence of successful collective action?

Although the nature of watershed projects in the cases analyzed above are perceived by the intervening parties, setting a negotiation and joint learning processes to share understanding on multifaceted nature of causes and effects of problems regarding watershed development is more relevant. Driving factors of perspectives on alternative solutions can be based on institutional arrangement (Benin and Mali) or technological innovations (Togo and Burkina Faso. In the first scenario, social processes generated organizations to design and implement technical options. This was the case in Benin various functional committees for contour farming and the improvement of soil fertility on sloping grounds. In Mali social mobilization at community level enabled the achievement of stone bunds to control erosion. In Togo and Burkina Faso an emphasis was put on the development of ISFM option to gradually build farmers associations that would perform some collective functions such as access to farm inputs (fertilizers, pesticides and small machinery tools) and output markets participation. Smallholders adopted a successful collective action because they have understood the magnitude of the watershed development problems and perceived their interdependence and collective efficacy as a group or community in their watersheds. This result is an indication that smallholders have

moved from their strategic ways of doing things in their watershed to a more collective behavior (Brand, 1990).

If successful collective action for watershed development is to be achieved and maintained, then it is important for facilitators to use common theories to define the nature of outcomes and zoom in interactions at the appropriate level where collective efficacy can be realized. Making explicit the nature of problems and available options the smallholders are dealing with to identify public goods is a key to guide learning processes. Institutions for the IUGREN in Benin, village committee in Mali, and smallholder apex associations in Togo and Burkina Faso are examples of public goods. Contour ridges, stone bunds and rehabilitated forests need to be collectively maintained and constituted another type of public goods. Maintenance of institutions and key technical achievements required an appropriate strategy for the provision of public goods to reduce free – riding phenomenon which should affect negatively collective action. Interactions among smallholders enhance their assurance to build trust on successful collective action. They stimulated mutual learning and adaptation to new circumstances as the case of smallholders in Togo who split their learning groups in small size group to be more efficient in inland valley development activities.

Learning path with smallholders in their communities is more effective when a particular attention is paid to their objectives, perceptions and interests and to the different available endogenous resources associated with watershed ecosystems. The discovery of nutrient deficiency through participatory nutrient omission trials, smallholders in Togo and Burkina Faso have understood why it is important to invest in their land and they were motivated to adopt a successful collective action in mechanisms to facilitate their access to farm inputs.

Approaching smallholder organizations as a public good within the mechanisms to clearly defined rules and norms for governance is a condition to stimulate successful collective action and strong linkages with input dealers and micro-financing institutions to achieve defined targets. The more smallholders and these actors perceive mutual benefit within their activities, the better the conditions for effective cooperation.

External support to smallholders can take various forms like knowledge management and sharing in ISFM and the provision of incentives such as credits to maintain functional group. The more effective is the support to smallholders, the more stimulating the watershed development situation is for inducing voluntary behavioral change. Opportunities such as access to credit and extension are positive externalities for successful collective action within watershed development activities. This situation was part of the facilitating process itself, the means offered by intervention noticed in the Benin, Togo and Burkina Faso cases described above

The aim of mitigating poverty to enhance smallholders' livelihoods implies trade-offs between their desire to extract more resource from the CPR at stake and the protection of vital ecosystem services to ensure sustainability (Falkenmark & Rockström, 2005: 202).

Facilitating the provision of alternative sources of incomes for smallholders should be perceived as a way to reduce trade-offs effects which may constitute a barrier for a

successful collective action in CPR's use situation (wood in gallery forests, catchment's water) embedded in watershed development. Beekeeping in the rehabilitated forests, promotion tree nurseries, high value crops promotion like potatoes, and small scale food processing by women, are concrete examples from the Benin and Mali cases described above.

7. Conclusions

Watershed development is a complex process which involves many actions at different levels of natural and human systems. It is embedded in a wide range of technical and socio-economic interventions. Therefore, hard and soft skills are required to achieve useful outcomes to enhance livelihoods of smallholders in the West African context.

Common theories enabled a clear conceptualization of the nature of watershed development outcomes in terms of public good provision problem and CPR's use dilemmas. These problems can be overcome if successful collective action is being achieved. The paper has relied on insights from watershed development projects in four West African countries (Benin, Togo, Mali and Burkina Faso) to demonstrate that it is possible to mobilize ideas, concepts and theories from social learning, communication and management sciences to facilitate empirically the emergence of successful collective action for watershed development to improve smallholders' livelihoods. Major lessons in ways of catalyzing a process of change for successful collective action to happen are synthesized to inform researchers and practitioners for a sustainable watershed development.

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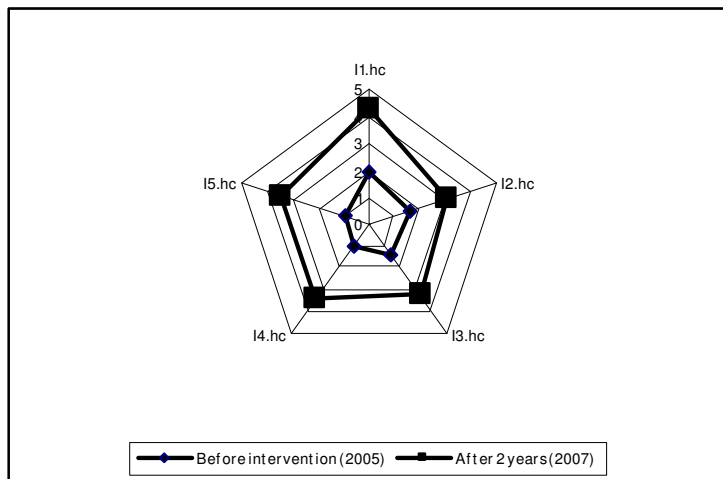
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Appendix 1: Effects of interventions human capital and social capital in the Togo case

(Source: Attigbévi-Somado, A. K. 2007)

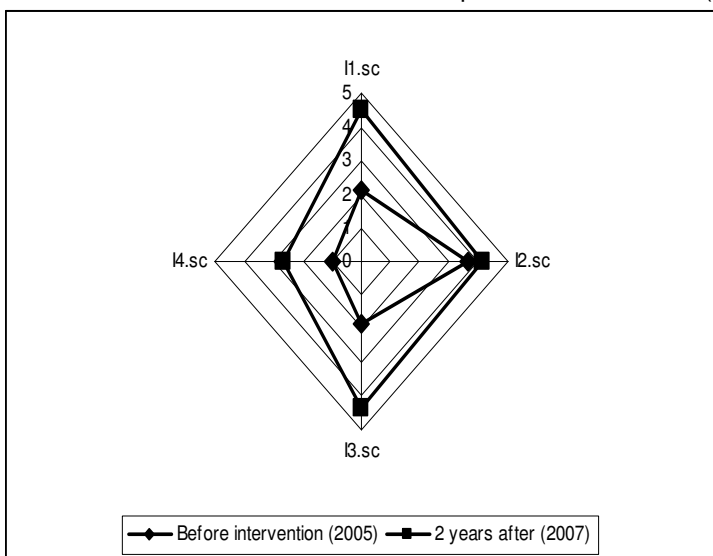
Effects of interventions on the human capital of smallholders (n= 78)



Definition of indicators used

- I1.hc: knowing the utility and use of inland valleys
- I2.hc: choosing appropriate crops to diversify agriculture in inland valleys
- I3.hc: knowing cropping practices in inland valleys
- I4.hc: knowledge on different types of fertilizers
- I5.hc: role of different types of fertilizers in plant nutrition

Effects of interventions on the social capital of smallholders (n= 78)



Definition of indicators used

- I1.sc: social organization
- I2.sc: decision making
- I3.sc: interaction between extension workers and groups
- I4.sc: linkage developed by groups