Participatory research: a comprehensive process for a new generation of researchers

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Keywords: comprehensive, diversity, complexity, action-research, integrator-researcher

Abstract

The participatory research approaches are regularly included in agricultural research project for development. Participatory research is a real comprehensive process. This article shows through two study cases the importance to understand the diversity and the complexity of a problematic and to take this into account before acting.

In the African Great Lakes region, maintaining soil fertility is a continuous challenge; its degradation is highlighted in the majority of the latest scientific publications. Meanwhile, peasants' ingenious practices to overcome this problem haven't attracted much attention. The first case study is about a systemic analysis of soil fertility management in banana-based smallholder farming in Burundi. Exploring the complexity of the rural realities, the method highlighted diversity in the practices as well as the multiplicity of farmers' problem-solving skills.

The second case study gives an example of this second step of the process: acting in a research-action project in South Kivu. Banana crop in the region has been attacked by a bacterial wilt for which there is no technical solutions. In this case, our method allowed co-constructing the reflex of prevention by training based on the local reality of farmers. By working in interactions with stakeholders, we made partnerships with actors at different level.

This methodological process redefines the role of researcher as an integrator between the micro level of farmers and the macro level composed with the actors of innovation network. This new kind of researchers needs to acquire some skills to assure this new job for facilitating transformation of agriculture.

Counting words

Abstract: 249

Full paper including references: 6025

Full paper without references: 554

1. Paradigm shift in agricultural research: new needs and approaches

The paradigm of agricultural modernization and his productivity growth hypothesis are currently challenged.

Materialized in the sixties with the Green Revolution, agricultural modernization sustains an increase in the crop yield through the use of inputs and technologies. This allowed a significant increase in production in the regions suited to its establishment. Nevertheless, 850 million still suffer from hunger and half of them are small farmers or farm workers living in rural areas (FAO 2012). The problem of hunger seems more ascribable to access and distribution than it is to production (Mathijs 2011). Moreover, modern agricultural paradigm seems not corresponding to the environment of the majority of small family farms, representing 85% of world agriculture (Von Braun, De Haen, and Blanken 1991). In these regions, these agro-technical approaches resulted in many failings, imputable to unfavorable institutional environment; but also to technical solutions unsuitable to farmers' real need, lacking consideration for their logic and their intrinsic capacities (Lavigne-Delville, Broutin, and Castellanet 2004). Otherwise, most of those who aren't in a situation of food insecurity are facing erosion of their income and their autonomy (FAO, 2011). This socio-economic crisis related to an “ill-development” is accompanied with an environmental crisis (Stassart et al. 2012). The global agri-food system is a major source of degradation of natural resources and its negative externalities are largely criticized.

In front of this double crisis, an agro-environmental transition of agrarian systems is getting under way. Agro-ecology puts into perspective the vision of agriculture and of innovation. From its point of view, external technologies are no longer at the center of the systems; it's rather the case of agro-systems' peculiar functions, like the optimization of the hydrologic cycle for example(Altieri 1989). The combination of ecologic and agronomic knowledge, together with peasants' scientific know-how, is therefore considered of primary importance (Stassart et al. 2012).

This transition requires change in the classical research paradigm (Collinson 2000). That calls for new approaches based on system perspectives and comprehensive framework. In Agricultural Research for the Development (ARD), farming systems research approaches promote interdisciplinary holistic framework, rather than a narrow technology or crop focus, and identified farmers’ problems and constraints as the basis for planning research and extension activities. That changes the model of technology development from a linear transfer of technology model to an iterative approach based on learning and adaptation. Adaptive methods and tools are therefore necessary. Among them, the participatory research can draw on both indigenous and scientific knowledge systems (Adrienne and Sherington, 1996). In interaction both with farmer and scientific and government institutions, the role of researcher also changes. Integrating farmers’ arguments, he/she can better approach the complexity of rural realities and farming systems. Besides, its outsider perspective on available technologies, new market opportunities, processing possibilities and policy influence draws on resources not normally available to local farmers or communities (Collison 2000).

In this article, we illustrate this systemic and participative approach as a whole process in action-research through two case studies focused on the banana-based cropping system in the Great Lake region. More specifically, we expose the researcher’s posture at two distinct positions: the MSc student and the PhD. In the first study, the student achieves the early step on the process: understanding the diversity as well as the multiplicity of farmers’ problem-solving skills. The second one array how the PhD takes it into account to propose solution adapted to local rural realities.

Context of the case study: The Great Lake region and the importance of the banana crop

Burundi and South-Kivu are located in the Great Lakes region, characterized by a particularly diversified environment and uneven reliefs. Its climate is tropical, tempered by altitude.

Small farms, with an average size of less than one hectare (Karamura et al. 1998) are located on the hills up to 20% of slope (Rishirumuhirwa 1993).

The current farms' organization is divided up in five different soils. The two main production systems are constituted by dense banana plantations encircling the house or “rugo”, associated with shade plants (1) and food crops associated with scattered banana trees (2). The cultivation of cassava or sweet potato, demanding very little contribution in fertilizers, are generally cultivated in single-crop farming on plots at times far from the habitation (3). Some afforestation or residual pastureland occasionally cover on the top of hills or slopes unsuitable to cultivation (4). In the “swamps”, referring to the small wetlands that separate the hills and the big marshland in the valleys, we can find different farming systems: beans crop rotation + corn or potato with rice, fodder weed, vegetables, etc. (5).

With a predominantly rural population, in this country the cultivation of banana have an important place, at the food, the social and the economic level.

Since last century, following the cultivation of pastureland and epizootic diseases, banana has replaced livestock as the new source of green manuring (Cochet 2001). Contributing for more than 50%, it represents the main element producing biomass (Rishirumuhirwa and Roose 1998).

Banana plantation means a lot to the farmers. First of all, is the source of food: juice, beer, starch, fruit, banana can be consumed in many forms throughout the year. The production method provides its perennial nature and ensures food security during hunger gaps.

Banana represents also the main and at times the only source of income for rural population, through the selling of bunches, juice or beer in local markets or to middleman (Picq, Fouré, and Frison 1998).

The multiplicity of banana's functions for population in the Great Lakes region, illustrates the complexity of the farming systems based on banana cropping and the need to adopt approaches that are capable to take it into account.

2. Case study on soil fertility in Burundi: MSc student’s posture to conduct a comprehensive approach to understand the diversity

This first case study illustrates the posture adopted by the second author as MSc student in agronomy to conduct a systemic assessment of soil fertility management in banana-based smallholder farming in Burundi.

2.1 Genesis

In Burundi, soil fertility is a permanent challenge for farmers. Temperatures that are propitious to chemical alteration and the humidity condition, together contribute to diminish intrinsic soil fertility. Besides, higher pressure on arable lands leads to cultivation of marginal soil and to the fragmentation of plots.

Scientific researches in this domain generally adopt a quantitative approach, based on scientific expertise. These may, for instance, assess the amount of nutrients and underline mining agriculture practice.

In Burundi, international development programs are promoting the Integrated Soil Fertility Management (ISFM). ISFM is defined as an organized set of practices for soil fertility management, which implies necessarily the use of chemical fertilizers, in associations with organic fertilizers and the use of improved seeds (Vanlauwe et al., 2010).

Fertility degradation marks the consensus among the vast majority of scientific papers and development programs. Meanwhile, peasants' ingenious practices to overcome this problem hasn't attracted much attention: they develop specific strategies to overcome constrains and these strategies are suited to the local specific conditions. Capitalize on the diversity of these practices and to understand their foundations, is an essential scientific exercise.

This first case study analyses soil fertility management practices in smallholder farming, trough a systemic and comprehensive approach based on peasants' discourse.

2.2 Methods

We have conducted semi-structured interviews in three provinces in Burundi (Gitega, Cibitoke, Ngozi), characterized by different agroclimatic conditions. The in-depth interview process was guided by an outline of open-ended topics that cover a broad range of themes linked to soils fertility management. For this last topic and using snowball sampling (Pires 2007), the names of other interesting actors were collected. The sample therefore constituted during data collection with the aim of maximizing the diversity of structures and practices. The final sample was constituted of 23 farms. Through these interviews we aimed to:

1. Identify the distribution of the biomass between different plots in a given farm, and to try to understand the “how” and the “why” of such actions;

2. Identify the factors contributing indirectly to soil management: i.e., to understand farmers' drivers and expectations.

The totality of the interviews was transcribed. To analyze it, we coded the transcriptions with keywords using qualitative data analysis software (R software's RQDA package).

The data resulting from the coding of the interviews was cross-referenced with those resulting from plots' direct observation. Hence, we have listed the fertility flows within an m x n matrix. Through a clustering by fuzzy method, a typology was created from the matrix, leading to identifying four groups of farmers/farming practices. Building upon these results we developed a resource management model, enriched by farmer's justifications.

2.3 Results

Despite a relatively small sample, we observe diversity in fertilization techniques (1) and in motives expressed by farmers to justify the latter (2). Resource management models illustrate this diversity (**Figure 1**).

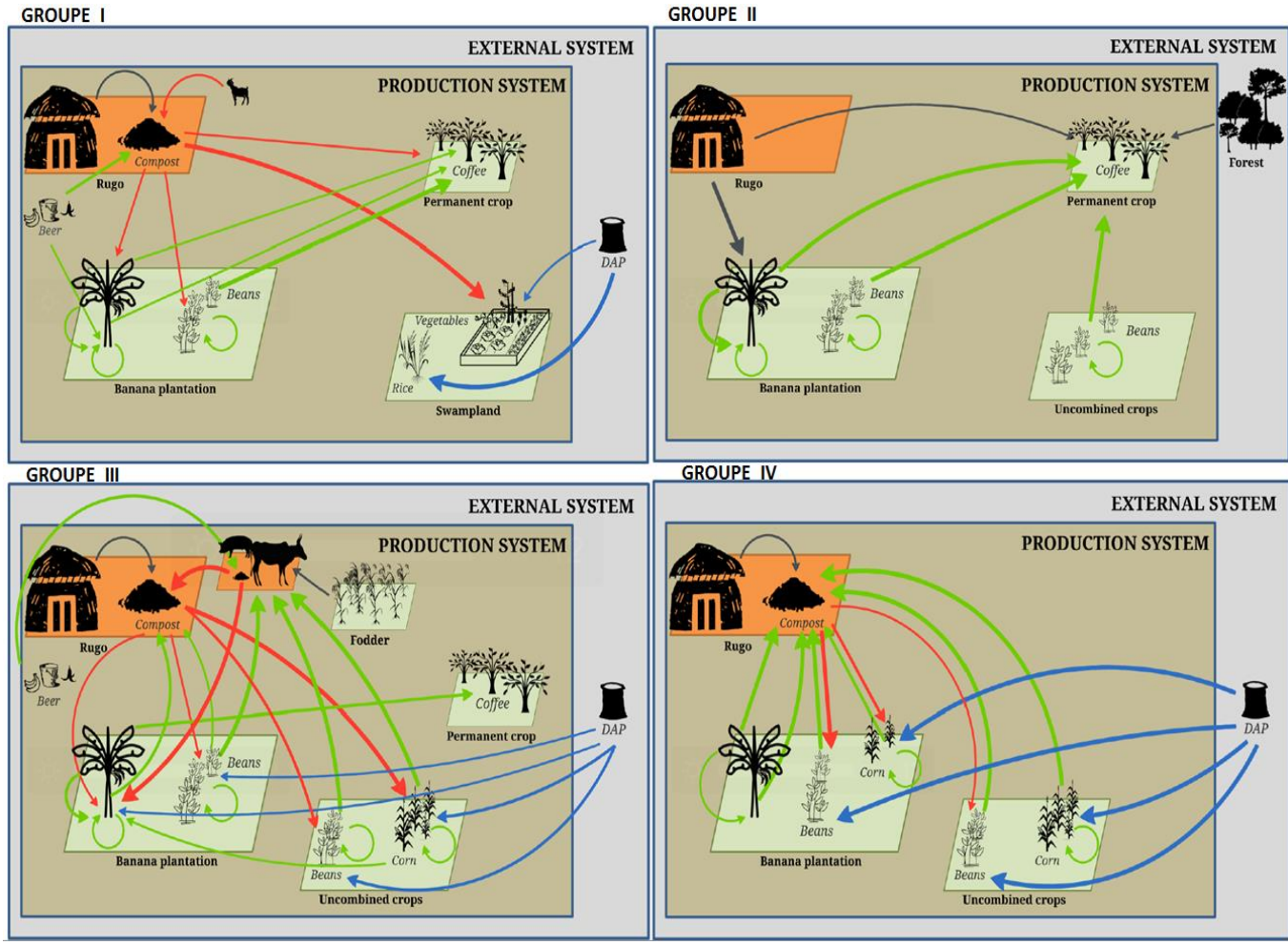
The groups differ notably in the nature and origin of the utilized biomass. Farmers from groups I and III possess livestock and can thus benefit from animals' manuring; whereas farmers from groups II and IV receive only plant biomass.

By letting small cattle graze outside the farm's limits and by importing leaves from surrounding forests, groups I and II mobilize external biomass. On the contrary, by conveying crops' residues to the livestock or to the compost, groups III and IV exploit only farm's internal biomass.

Discourse analysis reveals that farmers' scope of intervention is narrow and directly determined by the limitation of three fundamental resources: natural environment, work force and liquidity. According to farm's priorities, these three resources are allotted preferentially to certain activities.

The example of group IV illustrates this decision logic. The five farms have a surface area of less than 0.5 hectare and are located in Gitega, one of the least fertile zones of Burundi. In addition, peasants are compelled to work externally to meet their family's needs. In front of these constrains, peasants from this group implement fertilization techniques based on the primary role of banana plantation and the transfer of plants' residues toward the compost.

> « *You need resources to buy livestock. I cannot to afford it. So, what I do, I prefer to gather all the weed in the compost, I accumulate all the weed and once decomposed, I use them as fertilizer. That's all that we use; here, at my place* » [4114].



Legend: Green, red and blue arrows illustrate respectively cultures' residues, manure and chemical flux. The thickness of arrows depicts the importance of flux if resources are subject to different uses.

Figure 1: Resources management models[1]

Moreover, farmers compost feces and associate crops in order to make the most of the organic matter.

> « *I use toilets' manure. We have to find out other means to ameliorate the fertility of our soils… If I use compost, I can harvest few pans; but if I've used toilets' manure, I may harvest more than seven pans of beans. It's not the same thing*» [4121].

> *« In fact, if I fertilize beans and corn, the banana tree can take advantage from it, and with its roots it draws the elements that I have used for those two crops*» [4114].

Facing shortage of manure and limitation of financial resources and work force, farmers of this group resort sometimes to practices like chemical fertilizers and stubble burning; otherwise they would have themselves considered these practices as harmful to the conservation of soil fertility.

> «*Last season I didn't have organic manure. I have put some chemical fertilizer to maximize yield; but considering the long-term effect, it's negative…. It's harmful for the fertility of soils*» [4119].

[1] Icons used in the graphs created by Anand Prahlad, Francisca Muñoz Colina, Joel McKinney, Michael Zick Doherty, Adam Zubin, Lance Hancock, Liliane Lass Erbe, Ana Maria Lora Macias, Rhys de Dezsery, Agne Alesiute, Shawn Erderly, Ben Didier, James Fenton, Philip Glenn, Nastja Vivod, Francesco Cesqo Stefanini, Lucas fhñe, Luca Santomauro, Jose Morbàn, from Noun Project.

«I prefer not using burning (he refers to the burning of weed). However, when I get some work, I'm not here (he refers to his farm) to check what my spouse and children do. Them, they do burning even though it's not a recommended method» [4119].

Peasants of group III differ from the other groups by the means of production summoned up. They all possess big cattle (cows or pigs), bred in permanent stabling. Besides, they draw on substantially to chemical fertilizers, applied -in combination with organic fertilizers- on all crops except coffee. On the other hand, the animals being held in the shed, farmers must dedicate more work and efforts in order to harvest fodder, compost feces and to spread the decomposed manure.

Thus, they use more inputs and fixed capital per hectare and can be labeled as capital-intensive and labour-intensive. Group III seems to be as the most in tune with the agricultural modernization paradigm, according to which intensification is defined as yield per surface unit, through growth in work and soil productivity (Bonny 2011).

2.4 Lessons

In this case study, we adopted a systemic and comprehensive approach mobilizing social skills. As MSc student in agronomic sciences, we broke away from the technical logics to take into account the peasants' knowledge.

This approach allowed us to demonstrate the diversity and the judicious nature of farmers' fertilization techniques. In this way, far from ignoring soil fertility dynamic and the capital importance of its retention, peasants implement their practices depending on constrains and circumstances.

Diversity of practices nevertheless faces the homogeneity of expectations expressed by the farmers. A stronger integration of cattle, single-crop farming and the utilization of chemical fertilizers, in combination with organic soil-enriching agents are the three wishes that appear almost systematically in peasants' discourse. These practices correspond to the technologies of the Integrated Management of Soil Fertiliy (IMSF, GIFS in french), currently proposed by development programs. These tools are aimed mainly to intensify agriculture and increase its productivity. However, discourse analysis shows that peasants' case is not limited to increase production. They include other elements as well, like practical issues and notably the organization of the work (distance, weight, etc.). The diversity of practices in small farming system constitutes a real wealth for Burundi. It participates to the overall resilience of production systems. However, the homogeneity of farmers' expectations questions the durability of traditional farming methods: peasants have always been innovating but with the new actors of development they learn to adapt their expectations to the supply of these actors.

3. Case study on banana plant disease in Idjwi: PhD posture to act taking into account the complexity and the diversity

This second case study illustrates the posture adopted by the first author as a PhD in agronomy to implement actions for a lasting management of the banana disease by the farmers. This research-action started during her PhD thesis about Systemic analysis of innovation process in the banana-based cropping systems of the Great Lakes region.

3.1 Genesis

The Idjwi island is located in the Kivu Lake between Rwanda and Democratic Republic of the Congo in Congolese territory. It is a large island of 310 square kilometers with a high density of population: 160.000 inhabitants distributed in the North and the South of the island separated by a nature reserve (see Figure 2a). The population is primarily rural and there is no motor-road on the island (overview in Figure 2b). The island has been preserved of the regional conflicts taking place on the surrounding land of Kivu. The favorable tropical climate tempered by the altitude awards a great food production, particularly in fruits such as bananas and pineapples. Idjwi is considered as the granary of Bukavu and Goma, the capital cities of South and North Kivu, respectively.

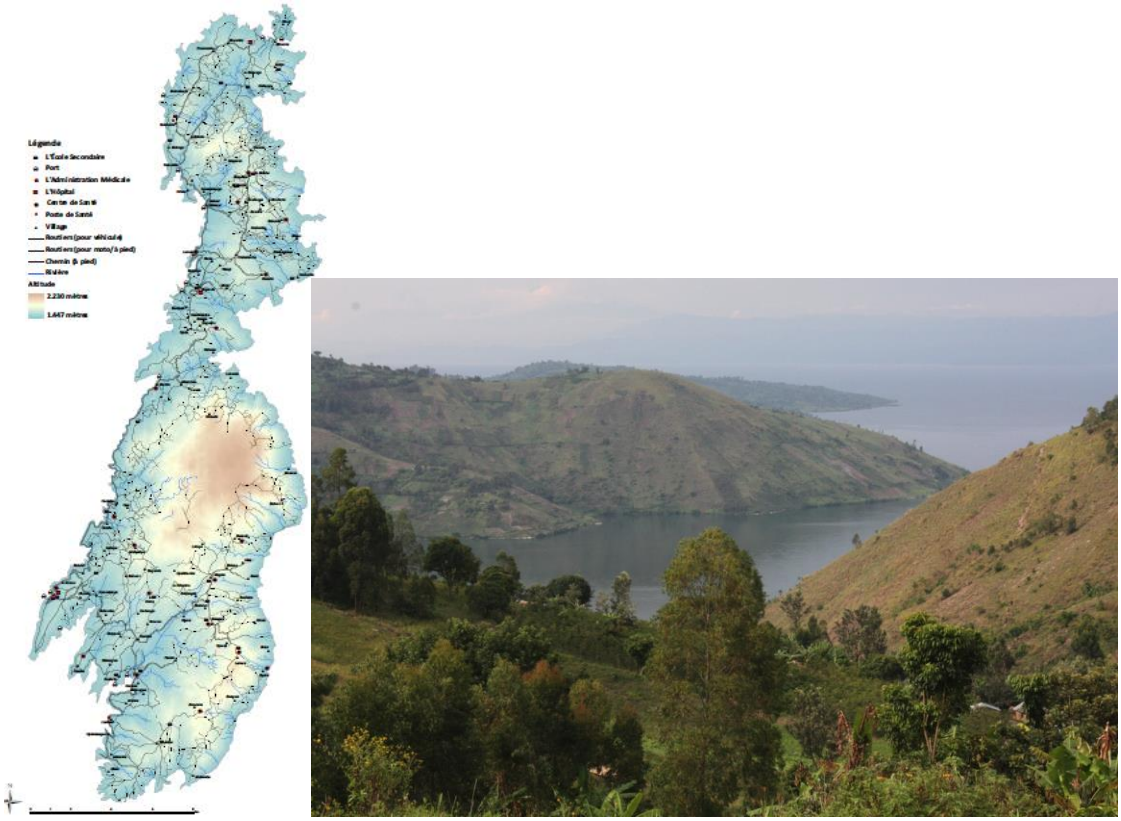


Figure 2 – (a) Map of Idjwi territory and (b) Overview of the rural landscape on the island

Since the beginning of the 2000, the banana plantations of a part of the Great Lakes region of Africa – including Idjwi island since 2004 - are attacked by a destructive bacterial disease: the Banana Xanthomonas Wilt (BXW). The bacterium causes the loss of banana production by withering of leaves, early ripening of fruit and production of bacterial exudate. There doesn't exist a technical solution for this disease, as resistant banana plant varieties for example. The only precaution (measure of action) is the prevention of the disease in the banana plantation.

The disease and in turn the reduced production has a dramatic impact for the farmers and islanders on food and nutrition, rural economy, household insurance, social exchange, ceremonies, and agronomic aspects.

We observed these damages during our first visit to Idjwi in February 2012. It was the last field trip in the Great Lakes before starting the redaction of my thesis (Idjwi was not in the study sites). The disease seemed epidemic since 2010 in the North and the South of the island. The farmers were bereft without information about the disease and the way of management. Only the local center for the rural promotion had a few notions of the preventive practices to respect.

Back in Bukavu[2], we had planned, independently of the observation in Idjwi, a meeting with the research-action partners who had collaborated with us during the thesis process, for defining the possible further actions in link with the banana. During the meeting, one of the partners highlighted the BXW as the priority issue. The next day, we invited the other stakeholders around the table and we created the Cell of coordination of the Actors in South Kivu for the management and the struggle of BXW (C-aSK of BXW). The cell was divided in two working groups: the first was a kind of legal group with the objective to get a by-law for the declaration of the disease as epidemic; the second group was technical and developed a framework of actions in three axes: (1) sensitization, training and organization; (2) transition; (3) replantation and reconversion.

Back in Belgium, we saw the experts in plant disease and asked to mandated authorities (the Belgian Head office of the Overseas development) about the actions in progress for this problematic. We discovered that a "survival funding" was granted by Belgium and that the FAO[3] was in charge of the operational working in the Great Lake region. But Idjwi was not in the action-sites of the first financing and could be included in the second, nine months later.

Nine months was too long for us. We decided to initiate a diagnostic and exploratory survey in the Idjwi island to complete the action framework and formulating the recommendations for actions.

Three months later - time for collecting a few money - our first observations, we were in Idjwi with a team of six people during ten days and covered the entire island with our data collection.

3.2 Methods and results

The data collection on Idjwi territory was organized around three methods according to the six objectives of the diagnostic and exploratory survey (see Figure 3):

- 136 **GPS localization points and determination of the category of infection** in each farm interviewed and with a systematic method for covering all the Administration Divisions (AD) of the island
- Six **focus groups** in each AD with one representative of each village and the head of the AD (12 à 18 people per group)
- 36 **individual interviews** in each AD with 1 or 2 farmers in each category of infection (healthy, early epidemic, epidemic, post-epidemic)

In 10 days, with six people and three methods, we produce almost 20 types of outputs for analyzing the BXW situation and the consequences in Idjwi covering the three axis defined by the C-aSK of BXW in February 2012.

The first assessment from the data about epidemiology proves the severe epidemiology state for the Idjwi territory: the large majority of the island is at an epidemic level with 64 villages out of 66 visited where the disease is present. The importance of damages due to the disease is proportional to the multiplicity of banana functions in the everyday life of population.

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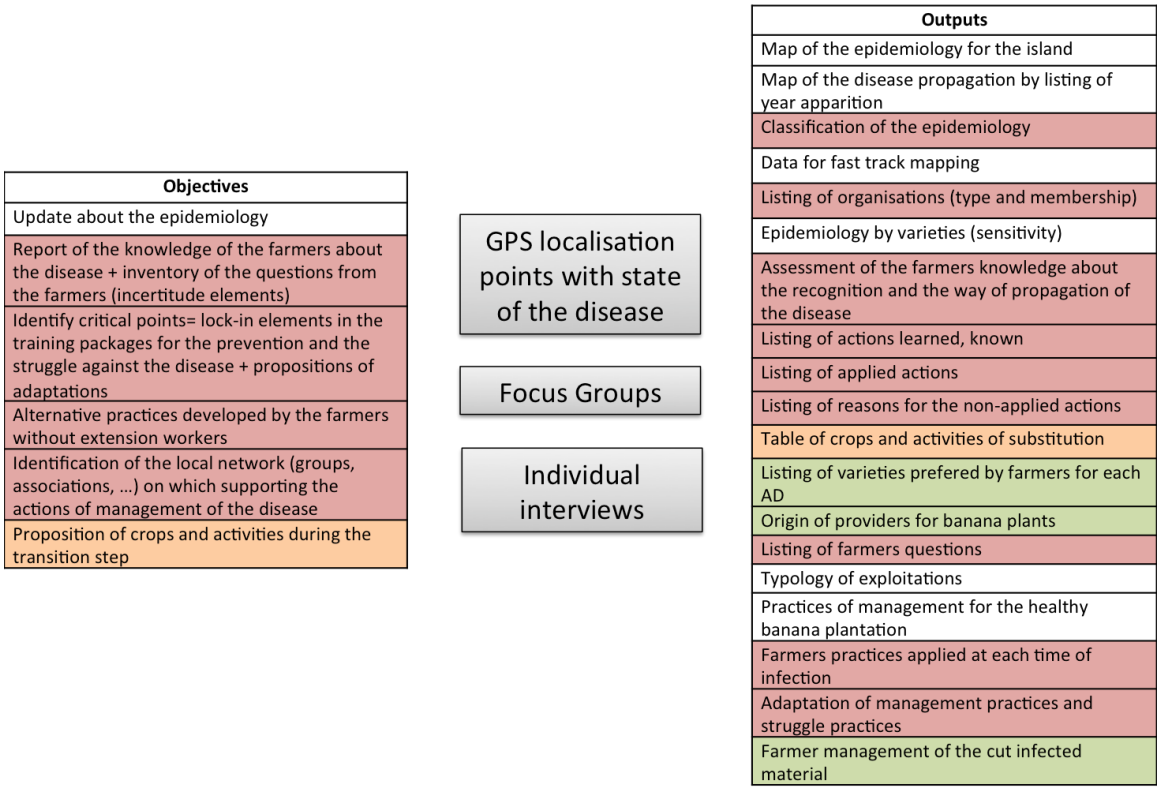
2 The nearest town close to Idjwi in the Southern Kivu part of the continent.

3 The Food and Agriculture Organization of the United Nations



Legend: white - information for diagnosis axis; red – information for sensitization, training and organization axis; orange – information for transition axis; green – information for replantation and reconversion axis.

Figure 3 – The three methods used to address the six objectives of the diagnostic and exploratory survey and the 19 types of outputs generated. The objectives and outputs are distinguished between the three axes of the actions framework defined by the C-aSK of BXW.

The main assessments after the survey in May 2012 were that (1) the farmers do not have the relevant information available and misunderstandings about the origins of the disease impair a good integration and implementation of the prevention and control measures. So doing reactions to the proposed practices are heterogeneous: some farmers display high motivation considering the massive impact of the disease, while others are daunted by the size of the challenge. In some cases, the measures taken are inefficient when not fully and carefully implemented and as a consequence, farmers are reluctant to pursue the struggle. The different levels of reaction are also proportional to the state of the epidemics. The prevention and control measures generate an increase in the workload in systems that already are very intensive in labour. All farmers are not equal in front of this workload increase. (2) For all actors, banana is a non-substitutable crop in the system. A transition phase (quarantine) or a strategy of substitution implies a full appraisal of all the functions of banana in the agricultural, social and economic system. (3) Most of the farmers are the members of an association but those have no or very few activities in relation to banana cropping.

We present here only general assessments but full of precise results (ea. sorting of banana varieties by use; description of symptoms by part of the banana plant by the farmers; listing of conditions for the replantation, etc.) are available following this study[4].

[4] See annex 1 of the report “Food security risks in the Great Lakes region – Rapid response to the threat of banana diseases”, Baret P., Van Damme J., Colin J., Earth and Life Institute – Université catholique de Louvain

This analysis entailed recommendations along the three axis of C-aSK of BXW having to take into account the adaption of measures according to the epidemiology level: (1) Appropriation of advices by the farmers is better when the conversation starts from their own conceptions and practices. Use the “extension in resonance” for initiating a reflex in the mind and the practices of population (2) Transition: Cassava, sweet potato and bean (grown by women) can be substitution options for staple food role. Maize and legumes are possible to a lesser extent. Pineapple could be used for juice, beer and social aspect particularly in the South. Small businesses and husbandry are potential options for the economic dimension. Main requirements are a good provision in seeds and a real autonomy of farmers in their decision processes. (3) Replantation of banana has to be thought over in close connection with farmers. Sanitary status of the new planting material and relevant varieties are the key issues. Local networks have to be built around the banana issue[5].

3.3 Actions

The diagnostic and exploratory survey entails impacts at different levels of actions with various actors from the micro until the macro level (see Figure 4 in last part of this article):

- Signature of the by-law by the provincial government of DRC for the declaration of the disease as epidemic
- Inclusion of our university (UCL) by the Belgian Head office of Overseas Development as an actor in the Special fund (« survival funding ») and spreading of the FAO activities in Southern Kivu including Idjwi
- Set-up of production of healthy plant material by the collaboration of the Provincial Inspection of Agriculture and a Belgian NGO (Louvain Coopération)
- Mobilization of the Centre for the Rural Promotion in Idjwi: demonstration plot and broadcast on the local radio for the diffusion of information about the disease and the prevention practices
- Collaboration with Kidogos[6] and a local organization for the multiplication of healthy banana plants

The implication of UCL into the FAO funding enabled us to continue actions on the axis of training for the population of the Idjwi island with the application of principle of “extension in resonance”. On the basis of the results of the diagnostic and exploratory survey of 2012 and its updating in 2014 (outputs about report of farmers knowledge and questions) and the expertise of a phytopathologist, training for two groups (one in the North and one in the South of the island) around thirty people of three type: “pilots farmers”, extension officer, and local leaders/authorities are organized (training of potential future trainers). The training consisted of a part in classroom with a support for the trainer structured according to the main topics to address for understanding and struggling the disease. Each topic includes the questions and elements applied by farmers collected during the surveys and a part in the fields. Four copies of this support guide has been left for the handover to potential trainers. A second fundamental part was provided in the fields for the observation and the demonstrations of the information taught during the discussion part. A last part was provided for the agronomists: a methodology of diagnostic for the disease with the use of detection kits.

After this essential process of training, a collaboration with a local dynamic supported by a small Belgian association has been coordinated for an action in the last axis of the CaSK-BXW framework: the replantation. In a first step, the trained people in the North and the South teach themselves more or less three others farmers having taken part in the survey of 2012 and 2014 in priority. In a second step, in the South, a technique of rapid multiplication of healthy banana plants was experimented with local materials. In 2015, 132 farmers have benefited from healthy banana plants come from this scrupulous process including trained farmers and farmers having participated in exploratory and diagnostic survey.

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[5] The recommendations are also multiple. See report “Phase-pilote de contribution à la lute et à la gestion du flétrissement bactérien du bananier (BXW) au Sud Kivu”, Van Damme J., Earth and Life Institute – Université catholique de Louvain

[6] Non-profit-making organisation

3.4 Lessons

Giving a sufficient overview of the genesis and the process of actions was important to understand the importance to work in a comprehensive way and thus increase the likelihood of safeguard of success and the sustainability for projects in ARD. In comparison, in another country also infected by the disease, a recurrent annual funding allows the massive distribution of banana plants. The varieties distributed are imported from research centers and considered as improved but they are not adapted for using and practices of farmers. Only two or three different varieties are provided while more than ten was multiplied in Idjwi with the consultation of local farmers for taking into account the local preferences. No information or training, whether it is about the techniques for growing these imported plants or about the prevention practices against the disease, is provided with the distribution. In consequence, each year more than one million of euros are spent for the distribution of new banana plants that even the farmers start to weary these material which do not give anything over the years.

The case of management of BXW in Idjwi island has taken around 3,5 years since the observation of the first symptoms and the replantation of healthy banana plants. And, it will take again more than one year for consumption of banana from this process by the households. A whole process of five years, yet accelerated by four key elements of success: (1) the knowledge of banana-based cropping system by the timing at the end of the phase of data collection for the thesis about this; (2) the systemic (comprehensive) approach and the methodology used (co-construction of innovation) developed during the PhD process and proven by accident in Idjwi ; (3) the network of efficient partners met at the occasion of others research-action experiences during the PhD ; (4) the background of phytopathologist. A process with the succession of three essential steps: the rigorous technical diagnosis and the exploratory survey in a comprehensive way, the training in resonance with actors and only after that, the replantation in consultation with farmers and local infrastructures.

4. A new role for researchers in ARD: the integrator researcher at the interface between the actors and the disciplines

We tried to illustrate the importance to take into account, the diversity of practices and the complexity of the realities with the interactions between the elements of a system including the actors. The first case showed the diversity of soil management strategies implemented by farmers depending on constrains and circumstances. This diversity faces however the technological packages spread by the development programs. The second case took place in context where there wasn't technical solutions to diffuse like a resistant variety. The classical actors of research then were deprived of their usual tools (diffusion of a technical solution) and our comprehensive approach made it possible to get results.

In these two study cases, the researchers have distinct positions (respectively MSc student and PhD). Nevertheless, they both adopt a posture allowing systemic and participatory approach required for successful research-action.

In this last section, we propose to gather the key-elements of the approach in a new role for the researcher in ARD: the integrator researcher.

4.1. The interface of actors

In ARD, the actors of the network of innovation are organized around three levels of decisions and actions: (I) the macro level with the national and international institutions of ARD: the governments and the overseas development, the research centers and universities with the specialized scientists, the funding organizations, federations, associations and NGOs; (II) the micro level composed of the farmers and their representatives; and (III) the meso level, between the macro and micro levels, gathering all the actors whose mission is to diffuse from the macro to the micro level the technical and organizational propositions (innovations). This level includes decentralized authorities and agencies, local associations, NGOs, federations and cooperatives.

In this model, the diffusion of innovation is top-down from the macro level to the micro level with a rapid diagnosis of the problems and a conception of the solution at the macro level with

large effort deployed by the actors of the meso level for the adoption of this solution. In our case studies, however, we granted time to the observation and fine comprehension of the systems thanks to an original combination of tools resulting from agronomy and social sciences. During this stage, the issues and the capacities of the micro level are also identified and objectified by the researcher (at the meso level). Unlike a rapid diagnosis, this kind of rigorous analysis is able to make emerge and design relevant innovation (technical, social, institutional, etc.).

On the basis of the exploration - in a transversal way through the level of actors and through a geographical way in a same level of actors - the integrator researcher can compose with the knowledge and the practices of the farmers identified at the micro level and with the technical and organizational proposals of the other actors of the network of innovations according to the needs and realities identified at the micro level.

4.2. The interface of disciplines

The actor at the meso level in ARD has generally the background required to challenge and consult the other actors of the network of innovations (at macro level). However apprehending the micro level implies a set of methodological principles (from social tools) to define the problems, the propositions of solutions and the framework to evaluate its relevance (Cornwall, et al. 2002). Among those, the most important is undoubtedly the capacity to enter in dialogue with the farmer and to help him to express the reasoned choices that it poses according to the constraints that he/she faces. These choices reflect indeed the strategies, more or less conscious and explicit, of adaptation of the peasants to the agro-ecological, socio-economical and institutional conditions in the continuation of their objectives (Yung and Bosc 1999).

In the case of Idjwi, we chose of working with “technicians of rural development (TRD)” rather than agronomist. Indeed, it is easier for TRD to learn the principles of plant pathology than for the agronomist to learn the comprehensive attitude for exchange knowledge with the farmers. The education of the agronomists in developing countries of the Great Lakes region is indeed in a very top down approach. The acquisition of social skills as described above implies a back-education more complicated than a technical training for the TRD with a social background.

4.3. Becoming an integrator

For summarizing in the Figure 4, the actor-integrator takes on several functions. He/She is first an actor integrated into the system that he/she is analyzing in which he/she delivers himself inputs during all the process of knowledges’ construction. He/she is also a rapporteur (marks with arrow 1)-translator (arrow 2) of the needs and challenges for the micro level towards the macro level for a best taking into consideration of these. As an integrator, after the identification of the issue at the micro-level, the researcher can combine on the one hand the knowledge and the practices of farmers acquired (arrow 1) and on the other hand, the capacities and the technologies developed by the researchers (arrow 3). In back, he/she is also a rapporteur-interpreter of the innovations (in the sense of technical, organizational, etc. propositions) from the whole of actors of the network of innovation (including farmers from other contexts) towards the actors of the micro level. So that the peasants can adapt and integrate those that are best appropriate to them (arrow 4).

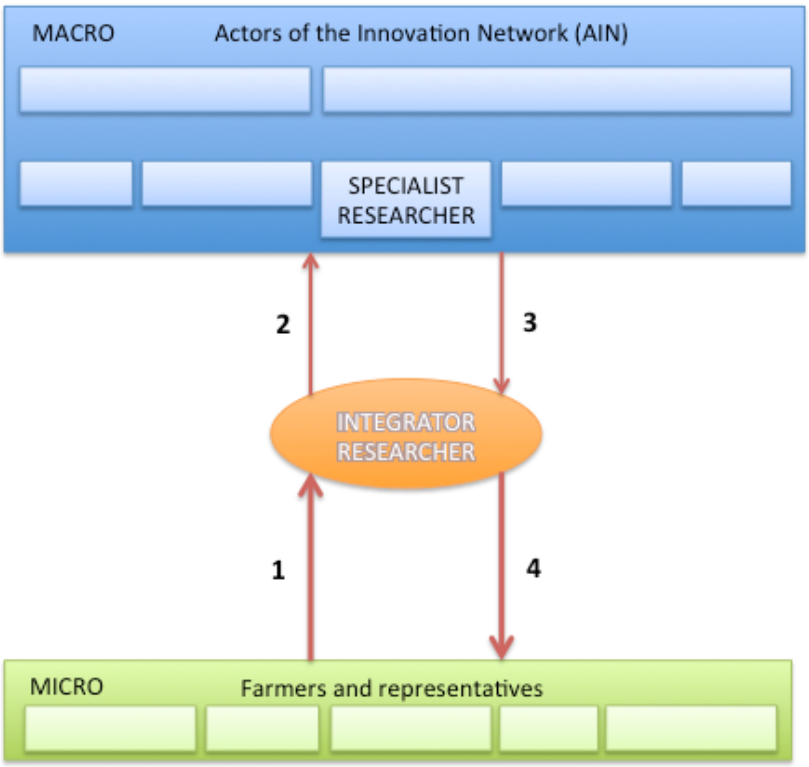

Figure 4 - Scheme of the integrator researcher and its functions at the interface between the actors of micro and macro levels

This new type of researcher at the interface of actors and discipline requires the acquisition of new skills notably from social sciences and a comprehensive posture (Ruault 1996). Without advocate that all the researchers must become integrators, these new competences and approaches should be include in the course of the students in agronomy in order to give them the possibility of choosing their way without gaps to be filled after their studies.

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