"The most important thing I have learnt is the passion for testing new things"

Sparking small scale dairy farmers' enthusiasm within a transdisciplinary project in Kenya

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Abstract

Small-scale dairy farming systems in Kenya are low-external input systems and therefore show a high context dependency. As most small-scale farmers have low capital endowment and have poor access to new information, they do often not see chances to improve their situation on their own. Fostering change in such systems requires methodologies that give farmers voice in the research process and that integrate and expand farmers' knowledge and capacities, leading to improved action. As part of a transdisciplinary research project, two small-scale dairy farmer groups in Nakuru-County Kenya engaged in a collaborative learning process. This article seeks to analyse the processes that contribute to successful facilitation of farmers' experimentation and innovation. We want to understand how enthusiasm was triggered, maintained, or suppressed. Enthusiasm is defined as a desire to engage with practices that draw on the energy, imagination and ideas of an individual or group (Russell and Ison 2000). We found that enthusiasm played a role throughout the four collaborative learning phases, i.e. establishing the collaboration, dialogue, discovery and application. Democratized research relationships sparked enthusiasm during the steps of establishing the cooperation and dialogue, while a sense of progress and success maintained it during the steps of discovery and application of new knowledge. The article concludes by stressing the importance of new forms of research, such as transdisciplinary research, that include local actors, i.e. those that can change the system by changing their actions, as partners in a knowledge creating dialogue.

Key words:

Transdisciplinary research; Enthusiasm; Farmer-led experimentation; Innovation system; Nakuru County, Kenya.

Introduction

Smallholder farmers in Kenya have limited physical and financial capital to improve production conditions. For this reason, smallholder farming systems are also referred as *low external input systems*. Such highly context dependent systems are characterized by multiple human-environment interactions over space and time. Agriculture itself represents a co-evolution between society and environment (Bacon et al., 2012). Thus, any attempt to bring about sustainable change in agricultural systems requires a *social-ecological analysis,* i.e. an analysis that considers how agriculture produces landscapes that are social, cultural and ecological (Cronon, 1996). In agricultural systems, social-ecological analysis focuses on how farmers deal with variability and change and how this change

occurs at the individual and the collective level (Coughenour, 1984). Hence, when analysing such coupled systems there is an emphasis on understanding agriculture as a *human activity system*, i.e. a system established and managed by farmers with their actions and knowledge (e.g. Bawden et al., 1984; Woodhill and Röling, 1998; Dillon, 1992; Valentine, 2005; Caporali, 2007; Halliday and Glaser, 2011; Kaufmann, 2011; Bacon et al., 2012; Blythe, 2012; Lescourret et al., 2015; Kaufmann and Hülsebusch, 2016; Moraine et al., 2016; Restrepo et al., 2016).

As most small-scale farmers generally have low capital endowment and are often isolated from networks of regional and global communities, i.e. have poor access to outside information, they often do not see chances to improve their situation on their own. Fostering change in such systems requires methodologies that integrate and expand farmers' knowledge and capacities, leading to improved action. The contextuality of smallholder farmers' systems calls for a transdisciplinary research, i.e. open to *real world actors*. In transdisciplinary research approaches diverse knowledge systems bring multiple perspectives (from academic, practitioner and other societal actors) enable a better understanding for finding applicable solutions to *real world problems* (Stokols, 2006; Lang et al., 2012). Consequently, contemporary approaches to generate practically relevant knowledge take into account the local context and address real world actors' perspectives (including researchers) of the problematic situation through dialogue.

As part of a transdisciplinary research project, two small-scale dairy groups in Nakuru, County Kenya engaged in a collaborative learning process. Groups were invited to apply for farmer-managed innovation funds. The funds were directed at learning about, and experimenting on, key constraints in the farmers' agricultural system, i.e. to stimulate farmer-led experimentation without individual farmers bearing the financial risk of experimentation. Hoffman et al.(2007) acknowledge the power of informal modes of farmers' experimentation, while Wettasinha et al. (2014) stress the importance of experimentation that use only local resources in innovation development with marginalized smallholder farmers. Farmer-led experimentation is defined as the process by which farmers conduct informal trials or tests that can result in new knowledge (Rajasekaram 1999 cited in Leitgeb et al., 2014). We chose to work with a transdisciplinary approach in this research with farmers because: (i) one-size fits all solutions are not useful in context dependent systems, (ii) we acknowledge the importance of arriving at a common understanding of the problematic situation with all involved actors, and (iii) solutions identified and implemented with real world actors are more sustainable. This article seeks to analyse the processes that contribute to successfully facilitating farmers' experimentation and innovation. Within a collaborative learning process, we want to understand how enthusiasm is triggered, maintained, or deterrent in a collaborative learning process that promotes farmer-led experimentation. We pursued this line of inquiry with two dairy farmers' groups in Nakuru County, Kenya. Enthusiasm is defined as a desire to engage with practices that draw on the energy, imagination and ideas of an individual or group (Russell and Ison, 2000).

Materials and methods

Study site

The study area is located in Nakuru County in the Rift Valley of Kenya. Nakuru County is classified as having a humid to sub-humid climate (Muriuki, 2011), and it is favourable for dairy and crop production (van de Steeg et al., 2010). Two areas where selected, Mukinduri (0°58´S, 35°98´E; 2687 masl) and Lare (0°44´S, 36°00´E; 2160 masl). The first study site is adjacent to the Mau Forest

Complex, while the second is adjacent to Nakuru National Park. Mean annual precipitation in Mukinduri is 1400 mm, while in Lare it varies between 600 - 1000 mm (Figure 1).

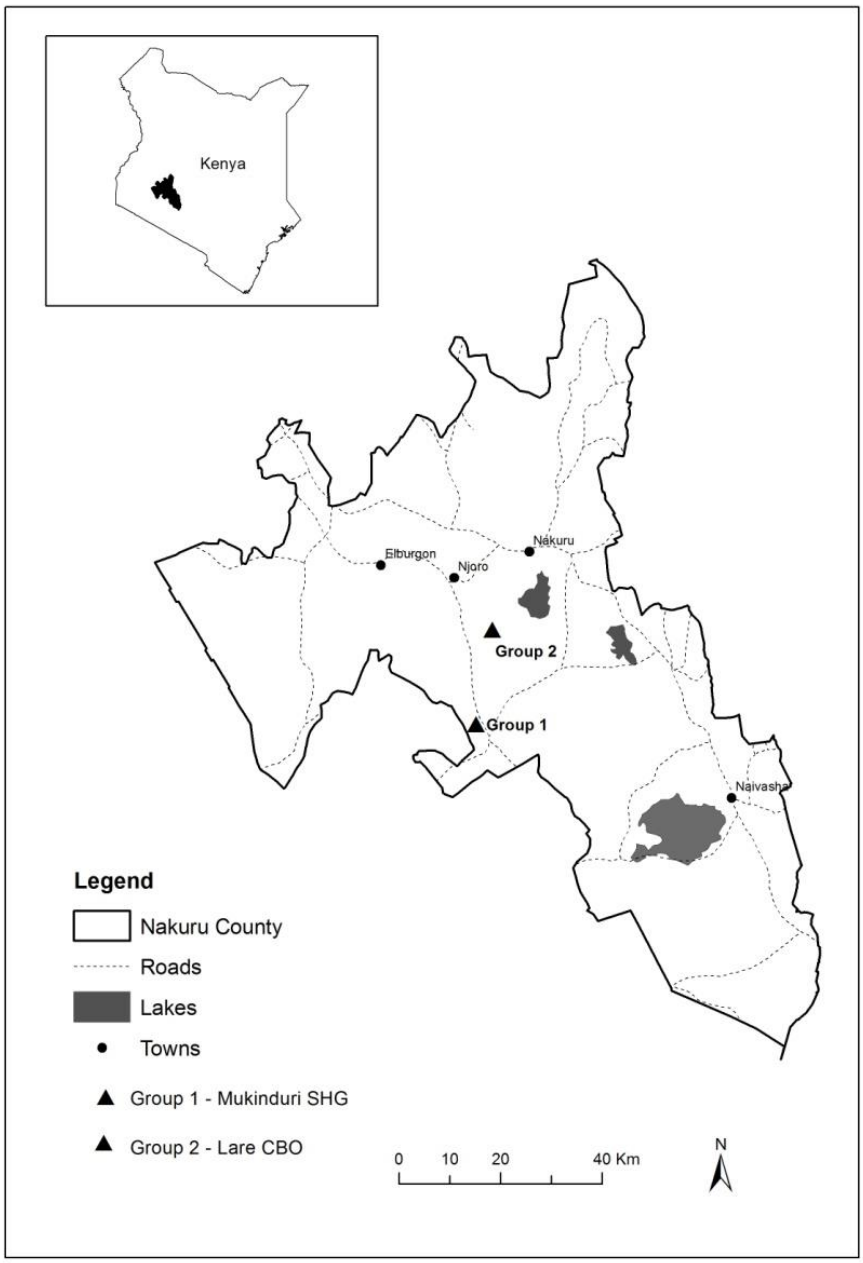

Figure 1 Map of Nakuru County, Kenya depicting site 1 (Mukinduri SHG) and site 2 (Lare Livelihoods CBO)

Smallholder dairy farmers in the study area usually keep one crossbred cow, with a maximum of three. Cows are commonly fed with Napier grass, crop residues from the farm (i.e. maize stalks, bean and pea stubbles, as well as residues from carrots, cabbage and potatoes) and weeds. Lactation periods vary between 7 and 24 months, as cows may continue to be milked even when they did not conceive in time. The majority of the daily milk is marketed and milk is also used for family food needs.

Data collection and analysis

A collaborative learning process was established with the Mukinduri group in August 2013 and with the Lare group in June 2014. Farmers' perspectives on the experimentation process were systematically documented from February to November 2015 using a combination of oral and visual methods. We conducted a series of complementary inquiry methods to assess what farmers have learned and how they evaluate the collaborative learning process. These included 12 semi-structured interviews (SSI) including critical incident questions related to their own motivation and satisfaction (Brookfield, 1995), participatory scoring of benefits from the experimentation process with all group members (n=40) (Holland, 2013), 5 narrative interviews (NI) exploring farmers' experiences during the collaborative learning process (Jovchelovitch and Bauer, 2000), and a group sessions to share the stories of change from 33 farmers (October 2015) using the Most Significant Change technique (MSC), a form of participatory monitoring and evaluation that provides data on impact and outcomes from actors' own perspectives (Davies and Dart, 2005).

The duration of the semi-structured (SSI) and narrative (NI) interviews was between 45 and 90 min. The stories of change (MSC) sessions lasted ca. 120 min. With farmers' permission, each individual interview and group session was audio recorded and transcribed. For the semi-structured interviews guiding questions were used to maintain focus; however, the interviews did not follow a formal structure but were rather conversational for reciprocity of dialogue. This approach allowed interviewees to feel comfortable and to focus primarily on the topics that they were most familiar with.

A content analysis was conducted with the qualitative information obtained. It included inductive and deductive coding of the data to identify similarities and patterns. Codes used were related to learning topics, benefits from the collaborative learning approach and relational aspects of learning. Tables and diagrams were constructed based on this information.

Context: Steps of a *collaborative learning process* with two farmer's groups

Two small-scale dairy groups in Nakuru County, Kenya, engaged in a collaborative learning process as part of a transdisciplinary research project for reducing food losses and adding value. This project was conceptualized as four interconnected phases (for further information see Restrepo et al., 2014): (A) establish the collaboration; (B) process of dialogue; (C) process of discovery; and (D) applying the new knowledge (Figure 2).

During the process of *establishing the collaboration* a partnership was institutionalized between the two small-holder dairy farmer initiatives and the researchers. Farmers had the status of co-researchers, i.e. they had voice in the process of defining, designing, testing and implementing sustainable solutions for a jointly defined real-world problem.

The process of *dialogue* enabled: (i) development of a shared understanding of the complex problematic situation, i.e. problems related with milk quantity (seasonality and work load), quality (cleanliness and milk composition) and market (rejection and seasonality); and (ii) realization of a joint strategy for achieving goals, that included different types of fodder and silage to improve milk quantity, and both on-farm milk quality testing and construction of a zero-grazing unit to improve milk hygiene.

Through the process of *discovery* farmers were able to fill knowledge gaps and to develop innovations for problematic activities. The process consisted of (i) farmer-to-farmer exchange sessions with peers having silage, different types of fodder or a zero-grazing unit; (ii) farmer-led experimentation in order to gain experience; (ii) collecting information using different instruments, e.g. keeping records of milk production and testing milk density and mastitis incidence; (iii) analyzing new information and reflecting on what worked and what didn't during group meetings; and (iv) evaluating the results and drawing conclusions regarding what might need to be done differently.

After testing the different options, *applying the new knowledge* is the basis leading to the consolidation of a new activity into a more broadly recognized social practice. This phase is on-going.

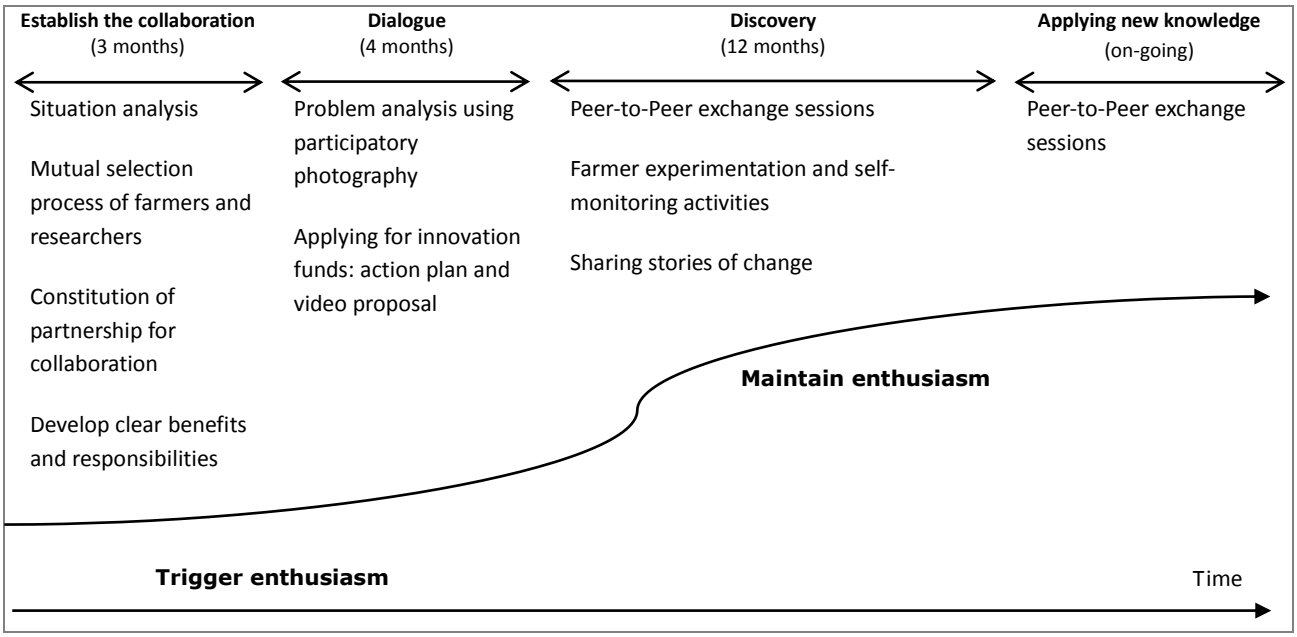

Figure 2 Methodological sequence in a collaborative learning process with two farmer groups in Nakuru County, Kenya

Enthusiasm

We found that enthusiasm played a role throughout the four collaborative learning phases, i.e. establishing the collaboration, dialogue, discovery and application (Figure 2 and Table 1). In the next section we will present different factors that triggered and maintained enthusiasm, both from farmers and researchers, during the different collaborative learning phases. Finally, we discuss tensions that suppressed enthusiasm, for both farmers and researchers. Through this section, we illustrate our findings with representative examples using farmers' own words.

Collaborative learning phase	Methodological sequence	Enthusiasm is Triggered	Maintained	Suppressed
(A) Establish the collaboration: Mutual selection	Situation analysis			Long and extractive process
	Mutual selection process of farmers and researcher	Valuing all actors - respect		
	Constitution of partnership for collaboration	Feeling of actual potential to make changes Forming hope		*Power imbalances (researcher-farmers)**
	Develop clear benefits, roles and responsibilities	Balancing power relations Mutual trust building		Hidden agendas
(B) D*ialogue:* Integrating knowledge	Problem analysis using participatory photography	A meaningful and rich way to share farmers' perception of the problematic situation Relevance Skills and equipment		Long process with no actions for farmers and results for researchers Time constraints Power imbalances (between peers) Imposed solution Inconsistent participation Position(s) of self-gain Not keeping session on time Un-effective communication among actors Monopolizing equipment
	Applying for innovation funds: action plan and video proposal	Open story for farmers to re-write (Dolinska and d'Aquino, 2016) Sense of ownership and commitment Agency Skills and equipment		
(C) D*iscovery:* Constructing knowledge	Peer-to-peer exchange sessions	Agency -Sense of "we can do it"	Re-defining roles among local partners	Not keeping session on time Ineffective communication
	Farmer experimentation		Farmers see themselves in the position to try new things based on their own priorities and conditions (low cost and based on local conditions) Ownership of experiments and results	*Imposed experimentation parameters** *Technologies not accessible** Unsuccessful past experiences Perceived risk Long process without actions/results
	Self-monitoring activities		Short term results - feeling of progress Monitoring effects of own ideas for improvement: - Milk quantity with records - Milk quality with lactometer Learning from each other Friendship and trust	Monopolizing observation tools *Imposed monitoring strategy**
	Sharing stories of change		Sharing perceived benefits - feeling of progress Friendship and trust Sense of pride	Not keeping session on time Ineffective communication among actors
(D) Applying new knowledge	Peer-to-peer exchange sessions		Sharing results with other farmers Increased self-esteem	

Table 1 Factors affecting enthusiasm during the Collaborative learning process

Theoretical items from the researcher's perspective

Establish the Collaboration: Mutual selection process

In establishing the collaboration, a mutual selection process between farmers and researchers was a first step in fostering enthusiasm as it fomented hope, as stated by one of the farmers during the Most Significant Change session "*I had one cow and ... I was contemplating selling it. But when we came together, I decided to keep it, because I saw some light*" (female farmer, MSC) (see also social capital in Figure 4). In the selection process, researchers, guided by explicit and implicit selection criteria, preferred two smallholder farmer initiatives to establish a partnership; Lare Livelihoods Improvement CBO and Mukinduri Dairy Self-Help Group. Importantly, the two farmer initiatives also chose the researchers to facilitate the process by proactively engaging with the researchers and expressing their desire for a collaboration contract. Both groups represent bottom-up initiatives, and are an example of farmers coming together because of their willingness to change, as can be seen with the following quote: "*Let's say the issue of joining the group was not in me. But the chairman told me ... that they are very much interested in learning more about dairy farming … In this area there has never been a group like this one*" (male farmer, NI).

Once the collaboration was institutionalized, we worked on balancing power relations so that everyone's knowledge and experience was recognized as important: "*we are all learning and no one is ahead of others*" (male farmer, NI). After clarifying roles and responsibilities, the size of the group in Mukinduri became smaller "*when we formed the group we were 47 members, and that group just reduced in size because some had different aims where some had thought that the researcher had come with money*" (male farmer, NI). Farmers with unrealistic expectations left, leaving only those willing to take the risk of embarking on a learning process into uncharted territory. As a young farmer stated, "*we did not know that there is a way you can learn, even if the person (researcher) does not give you anything, she can teach you and you get that knowledge*" (male farmer, SSI). This is an expression of the trust that was built during the first steps, but also of the desire to engage and change.

Dialogue: Integrating knowledge

Using participatory photography, researchers facilitated the problem analysis from farmers' perspective, something that was later much appreciated by the farmers themselves. As one of the farmers in Mukinduri remarked, "*it was good that we were capable of talking about our problems .... Even if our government listened to our problems and we were assisted, it could be of great help. Perhaps this could be done using a video just like we did*" (male farmer, SSI). Possible solutions emerged, after which the development of an action plan was facilitated. Farmers applied for an experimentation grant using a video proposal which served to jointly re-conceptualize their experimentation plan. The grant was intended to stimulate experimentation without farmers bearing the financial risk. In the *dialogue* phase, coming to a common understanding of the problematic situation triggered enthusiasm by promoting relevance, ownership, and commitment (see social capital in Figure 4) as stated by one young farmer in Lare "*everyone participated in planning even if they did not appear in the shoot (video proposal)... we were happy because we knew we are part and parcel of that. The video brought us all together because we had to discuss and agree upon what to do. It helped in decision making*" (male farmer, SSI).

Discovery: Constructing knowledge

In the discovery phase, farmer-to-farmer exchange sessions grounded farmers' experiments and enhanced a collective sense of `we can do it´. As stated by one of the farmers, "*When we visited his (peer's) place I was able to learn a lot in making silage practically. I saw that I can also make mine because he has already done his. So, I was able to follow from step one to the last steps*" (male farmer, SSI). Exchange sessions permitted farmers to see how peers are addressing the same problematic situation by making silage and planting different types of fodder for cows. It further increased farmers' agency, as farmers had the space to test and evaluate how silage and different types of fodder could work and to resolve doubts. Exchange sessions were also important in re-defining roles as *teachers*, as stated by one of the farmers that facilitated the exchange session, "*when I was going to teach them I was happy that I was chosen ... although initially people were fearing to try silage, now they are doing it"* (male farmer, SSI).

Subsequently, farmers developed their own trials to test sustainable practices to improve milk quality and to buffer seasonality based on different feeding strategies. Figure 3a shows farmers' participation in the farmer-led experimentation aiming to improve milk quantity and quality and to buffer seasonality. Farmers had in their hands the decision of what to test according to their current situation. For example, weather condition, land availability and labour; the experimental year was a dry year in Lare, and in Mukinduri farmers had already allocated most of the land for other crops. Enthusiasm was maintained during the experimentation process as can be seen by the high level of satisfaction (Figure 3b).

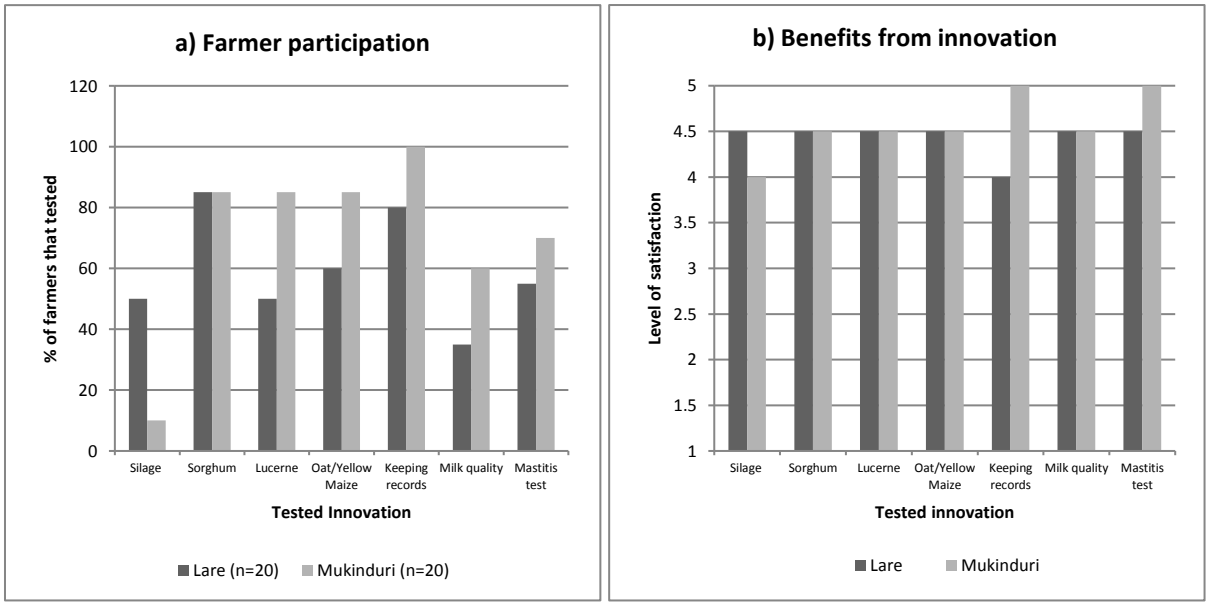

Figure 3 Farmer a) participation in, and b) perceived benefits (5 Excellent – 1 Bad) from farmer-led experimentation in a collaborative learning process in Nakuru County, Kenya (n=40; benefits only from those farmers that tested the innovation)

Farmers also tried different observation tools: keeping records, testing milk quality and early detection of mastitis using the California Mastitis Test (CMT). Using these tools, farmers implemented self-monitoring activities, which maintained enthusiasm by highlighting the progress achieved. For example, as seen by a young farmer's comments, "*since we started recording the amount of kilos (of milk) the cow produces, someone can say from here to here, that my cow has made a difference*" (male farmer, SSI). Farmers also used observation tools to further test the impact

of the different feeding strategies, "*I have used the lactometer. I wanted to know whether the density improved; it went from 26 to 29 and even 31. This was after feeding the cow with the new fodder*" (female farmer, SSI). Self-monitoring activities helped in maintaining enthusiasm. A young farmer stated that other areas of production activity were positively affected, "*if your cow produces low-density milk, the milk density rises when you add Lucerne (alfalfa). When you deliver your milk, it will never be rejected and they (milk traders) gain trust in you…"* (male farmer, SSI).

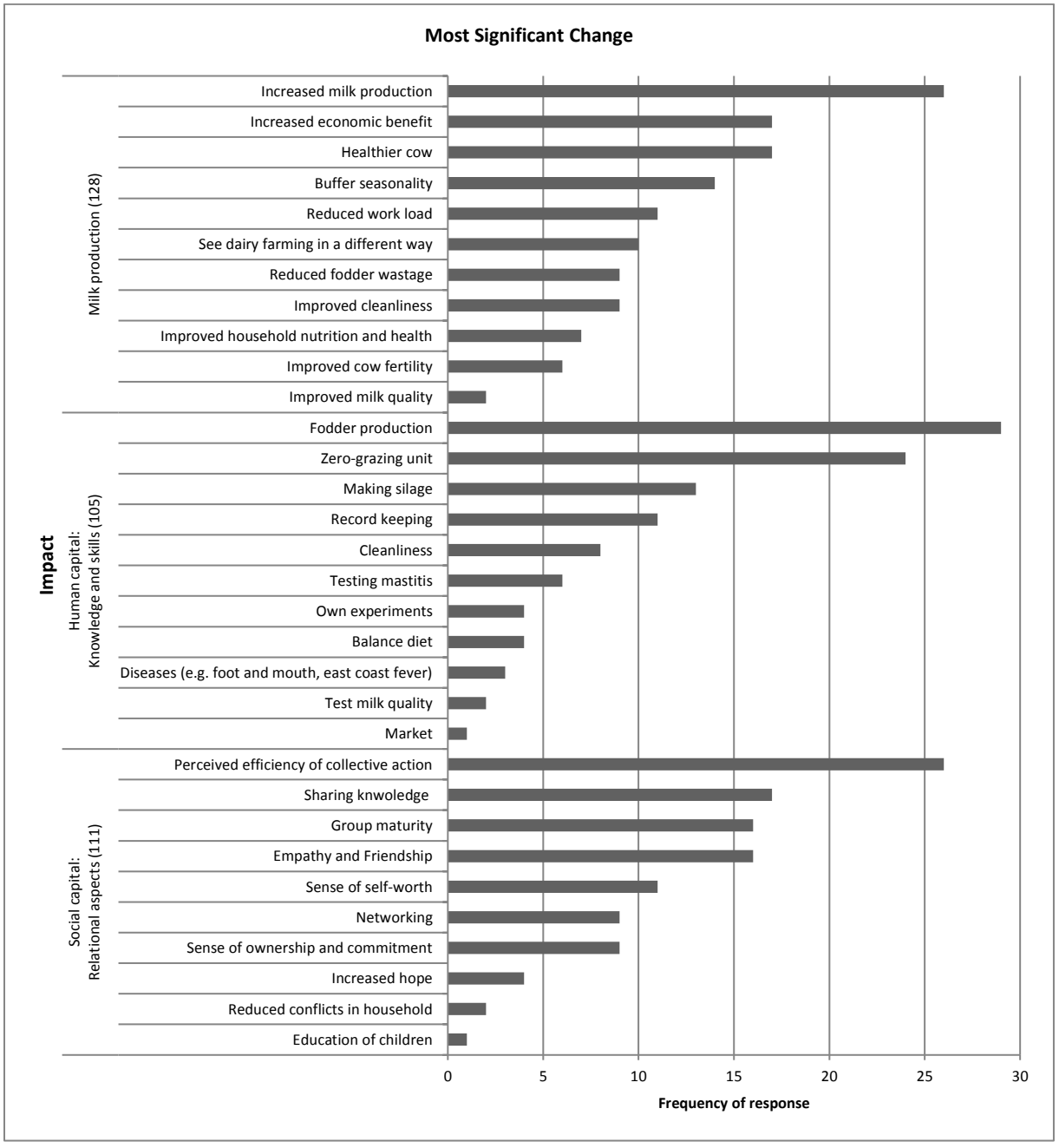

Figure 4 Perceived impact after sharing stories of change in a collaborative learning process in Nakuru County, Kenya (n=33; frequency of response; multiple answers per respondent)

Farmers emphasized the value of farmer-led experimentation, as can be seen by the following comments, "*it's a lot of power to learn and to practice*" (male farmer, NI) and "*we were discussing according to how we have learned, the knowledge is more than money. Because if it was money we would have shared amongst us, spent and forgot*" (male farmer, SSI). Experimentation was important

for maintaining enthusiasm, as it provided short-term results, "*I planted the seeds that we received for investigation… it was excellent, because the cow produced enough milk for my family and I, and we were even able to sell*" (female farmer, SSI).

The results from the individual experimentation were shared informally during casual meetings: "*through the group I have many friends, so in case I have any problem when we meet, I share the problems and exchange ideas. That has helped me a lot*" (Lare, MSC). Results were also shared formally during group meetings and through the Most Significant Change session. Here farmers commented what has changed during the collaborative learning project. Result from sharing the stories were grouped in those related to a) milk production; b) Human capital: acquired knowledge and skills; and c) Social capital: relational aspects of learning (Figure 4). Sharing results maintain enthusiasm as farmers' develop a sense of progress. Most importantly, farmers value the benefits from experimenting: "*I have seen the benefits of trying new things. I will continue experimenting*" (male farmer, SSI) and "*the most important thing I have learnt is the passion to testing new things*" (male farmer, SSI).

Applying new knowledge

In the application phase, group members implemented various innovations on a wider scale, which also expanded outside the groups. As an example, one young farmer in Lare has implemented silage and fodder at a larger scale, "*I have done so much silage that during this dry period I was able to share with my father, as he did not have enough fodder to feed his cows*" (male farmer, SSI). With the objective of selling the milk as a group, in Mukinduri, a small group of seven farmers pilot tested a local quality guarantee system, "*we (with six other farmers) implemented a system for testing milk quality every 2nd week to avoid rejection*" (male farmer, SSI). Finally, as stated by a farmer in Lare, "*the group is gaining recognition, and we are spreading our roots …*" (male farmer, SSI).

Tensions: factors that reduce or suppress enthusiasm

In our concrete experiences, *time* is an important factor that could suppress researchers' and farmers' enthusiasm. When working with farmer-managed innovation funds one needs to bear on mind that there are trade-offs between facilitating the initial phases so that the partnership is solid (i.e. balancing power relations; clarifying benefits, roles and responsibilities; preventing the occurrence self-gaining positions; improving decision-making among group members) - all require a lot of time to set up. In such partnerships, researchers need results while farmers want action. Inconsistent participation from farmers during the *dialogue* phase not only reduced enthusiasm, but also increased the time needed to arrive to a joint understanding of the problematic situation and an agreement on strategies to achieve goals. The time use in the sessions (i.e. participatory photography, video proposal, peer-to-peer exchanges or Most Significant Change) also affected enthusiasm when the sessions did not start at the agreed-upon time, or took longer than had been agreed upon by the group. The issue of time was contentious. A participant explained that, "*the challenge… for me is especially concerning transport… the journey is not short, but I sacrifice a lot because it is for my own good and also for the society in my area. So I make sure I arrive at the right time*" (Lare, MSC)

A situation analysis at the beginning of the project is seen as offering important initial information for the researchers, but farmers did not see the need for it. Moreover, they felt it was extractive and resulted from a hidden agenda. Both farmers and researchers also discovered that some members of

one of the farmer groups had a hidden agenda related to local politics, which created confusion and slightly reduced interest among other members for commitment.

During the *discovery* phase, unsuccessful past experience explained why the percentage of farmers that tested Lucerne (alfalfa) in Lare was low, as the dry season was strong and farmers knew the crop was not easy to establish. The percentage of farmers that tested silage in Mukinduri was low due to the perceived risks of failure (the innovation funds covered all materials except the crops from each individual farmer), and greater in Lare due to the imminent drought. Monopolization of tools to test for milk quality and mastitis not only reduced the number of farmers that tested them, but also had an impact on enthusiasm.

Finally, when working in a situation were not all actors (particularly the researcher) speak the same language, there is a need for an interpreter. Communication dynamics can reduce enthusiasm when: (a) the researcher and/or interpreter use overly technical or paternalistic language, in some cases pejorative terms; and (b) the message does not reach all members of the partnership in a timely manner (not all farmers obtained concrete information about dates, objectives and duration of sessions).

Discussion

This paper presents different factors that triggered, maintained, and suppressed enthusiasm during a collaborative learning process that promoted farmer-led experimentation in Nakuru County, Kenya. The reported findings demonstrate that it is possible to actively trigger and maintain enthusiasm through inclusive methods; participatory photography and video, farmer-led experimentation, self-monitoring activities, and sharing results. By analysing farmers' perspectives on the experimentation process, we highlight the importance of: (i) democratized research relations that included farmer-managed innovation funds to co-construct knowledge; (ii) building trustful relations; (iii) peer-to-peer exchange sessions; and (iv) sharing short-term results to accentuate a sense of progress.

For sparking farmers' own enthusiasm in a collaborative learning process that included farmer-led experimentation, one important issue is to give farmers an active voice in the research process, i.e. they can decide what they want to experiment on, how and why. Building the foundations of the research with the farmers implies having an open-story for farmers to re-write (Dolinska and d'Aquino, 2016). Hence, the emphasis is on shifting the project towards co-construction rather than transfer of knowledge, or, as Sewell et al. (2014) expressed, "sharing power with farmers". This also entails that farmers have the freedom to decide how they prefer to implement their experiments and what they prefer to observe according to their interest, curiosity or knowledge needs. Facilitating the use of different tools to observe and monitor (e.g. keeping records, on-farm testing for mastitis and milk quality), was also perceived by farmers as motivating. These observation tools were further used according to different needs and interests to self-monitor the outcomes from experiments. As Saad (2002) and Bentley (2006) argue, it is not necessary that farmers employ scientific methods (e.g. formal treatments, random trials or control groups) to experiment and learn.

Because of smallholder farmers' low financial capital endowment, working with farmer-led innovation funds is a good idea as farmers can experiment without bearing the financial risk. As stated by Ton et al. (2015), grants targeting smallholder farmers are a promising agricultural policy instrument. Farmer-governed funds have been widely implemented by PROLINNOVA (Wongtschowski et al., 2010). For these funds to succeed, it is important to work with group

dynamics to facilitate a partnership in a collaborative process. Faure et al. (2011) describe such partnerships in action research as the commitment of different actors who maintain their autonomy and bring together different human and material resources to achieve a shared objective. As stated by Rist et al. (2006), the willingness to collaborate in a partnership comes along with trust building, and the development of trustful relationships is related to less hierarchical patterns of communication.

The peer-to-peer exchange sessions helped farmers on one side to change their perception towards a determined technology and on the other side to become more aware of their own knowledge. For example, silage was perceived as something that only rich farmers can do, but after meeting peers that have adapted and adopted silage successfully, their own agency increased. Besides, peers who were visited became aware of their own knowledge when performing their new roles as *teachers*, also reported as a key factor in a social learning process by Rist et al. (2006). Finally, when farmers are experimenting individually or collectively they are also observing the results from their experiments. When they meet and share these observations, enthusiasm grows as they can see the progress.

Conclusion

The article concludes by stressing that democratized research relationships spark enthusiasm during the steps of establishing the cooperation and dialogue, while a sense of progress and success maintained it during the steps of discovery and application of new knowledge. The collaborative learning process supported farmers in (i) constructing knowledge that answered contextual problems, therefore improving the management systems; and (ii) strengthening their own agency. This example from two groups in Nakuru County, Kenya can serve to provide guidance on how to initiate, maintain and support enthusiasm through different stages of participatory research that hinges on empowered farmer-led actions.

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