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RESEARCH

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The value of trust in biotech crop development: a case study of Bt cotton in Burkina Faso

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Abstract

Background: Agricultural biotechnology public-private partnerships (PPPs) have been recognized as having great potential in improving agricultural productivity and increasing food production in sub-Saharan Africa. However, there is much public skepticism about the use of GM (genetically modified) crops and suspicion about private sector involvement in agbiotech projects. This case study sought to understand the role of trust in the *Bacillus thuringiensis* (Bt) cotton in Burkina Faso project by exploring practices and challenges associated with trust-building, and determining what makes these practices effective from the perspective of multiple stakeholders.

Methods: We conducted semi-structured, face-to-face interviews to obtain stakeholders' understanding of trust in general as well as in the context of agbiotech PPPs. Relevant documents and articles were analyzed to generate descriptions of how trust was operationalized in this evolving agbiotech PPP. Data was analyzed based on emergent themes to create a comprehensive narrative on how trust is understood and built among the partners and with the community.

Results: We derived four key lessons from our findings. First, strong collaboration between research, industry and farmers greatly contributes to both the success of, and fostering of trust in, the partnership. Second, this case study also revealed the important, though often unrecognized, role of researchers as players in the communication strategy of the project. Third, effective and comprehensive communication takes into account issues such as illiteracy and diversity. Fourth, follow-up at the field level and the need for a multifaceted communications strategy is important for helping push the project forward.

Conclusions: Burkina Faso's well-established and effective cotton selling system laid the foundation for the implementation of the Bt cotton project – particularly, the strong dialogue and the receptivity to collaboration. Interviewees reported that establishing and maintaining trust among partners, researchers and the community in Burkina Faso greatly contributed to the success of the PPP. By addressing challenges to building trust and engaging in trust-building practices early on, improvements in the effectiveness of agbiotech PPPs are likely.

Background

As the first West African nation to adopt and commercialize a transgenic crop—particularly, *Bacillus thuringiensis* (Bt) cotton—Burkina Faso is a trendsetter in its region. The use of Bt cotton has increased dramatically in recent years, boasting the second highest growth rate in the world. In 2010, Bt cotton hectareage increased by 126% from the level in 2009. Currently, Bt cotton crops are estimated to cover 260,000 hectares of land and have been adopted by 65% of farmers [1]. Critical to the development

and implementation of Bt cotton in Burkina Faso was the partners' effective collaboration.

In this study, we focus on Burkina Faso, Africa's largest producer of cotton [2], and the role trust played in the country's adoption of Bt cotton (see Additional file 1 for additional background information on the Bt cotton project in Burkina Faso). The 1980s and 1990s proved to be difficult years for Burkina Faso's cotton industry, as annual yields drastically decreased due primarily to destruction by pests [3]. In 1999, Monsanto approached the Burkina government with the Bollgard GM cotton crop to address pest resistance to pesticides and increase cotton yields [4].

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A generally low level of infrastructure and development in Burkina Faso presented a unique set of challenges to project implementation. These challenges were addressed primarily through the establishment of partnerships between public and private stakeholders involved in the Burkinabè cotton industry. Such partnerships presented additional challenges to building trust, from which we have distilled four key lessons on trust-building in agbiotech public-private partnerships (PPPs).

The success of agbiotech projects depends on the ability of partners to engage in long-term collaborations to complete complex tasks. The issue of trust is especially critical to agricultural biotechnology, since the introduction of transgenic crops and involvement of multinational companies can be contentious and breed mistrust [5][6]. This case was chosen as one of eight case studies in a larger study investigating the role of trust in the adoption of GM crops in sub-Saharan Africa, placing particular emphasis on the conception, management and development of trust in agbiotech projects. Selection criteria for the case studies included a) representation of a variety of products and technological innovations, b) ensuring appropriate regional representation, c) ease of entry and availability of participants for interviews/focus group meetings, and d) potential of transferable knowledge (both successes and set-backs). The three specific goals of this study are to: 1) describe trust-building practices in the development of agbiotech projects; 2) describe the challenges associated with trust-building in PPPs; and 3) determine what makes these practices effective or ineffective. By identifying barriers to trust and trust-enhancing practices, this study provides insight for potential funders, researchers, farmers and others involved in agbiotech initiatives.

Methods

We received Research Ethics Board (REB) approval for conducting the case study from the University Health Network (UHN), University of Toronto before proceeding with the study. Data collection consisted of interviews with key informants; review of historical documents and research articles; and observations.

Interviewees were identified first by making a list of key individuals associated with the project based on the stakeholders identified within the research protocol. This list was then populated further through snowball sampling. We spoke with stakeholder informants who were familiar with the Bt cotton project in Burkina Faso. Potential interviewees were sent an invitation, which included an explanation of the case study series, to participate in the interview. Those who consented to participate were informed that the interview would be recorded, transcribed and then analyzed. Interviewees included small-scale Bt cotton farmers, and stakeholders

from the following organizations: Institut de l'Environnement et de Recherche Agricoles (INERA), Agence Nationale de Valorisation des Résultats de la Recherche (ANVAR), Association professionnelle des sociétés cotonnières du Burkina Faso (APROCOB), Monsanto, and the West African Network for Communication on Agricultural Biotechnology (RECOAB). (see Additional file 2 for a list of the partners' roles and responsibilities)

The interviews took place in Bobo-Dioulasso, Sapouy and Ouagadougou, cities in Burkina Faso. The interviews followed a semi-structured, face-to-face format and each lasted approximately one and a half hours. The interview guide included questions on the interviewees' background, their understanding of the project, and their interpretation of the word *trust*. The interview explored perceptions of trust within the partnership and the public, apparent challenges to trust, and observed trust-building practices. Interviewees were also asked for advice on how to improve agbiotech PPPs (see Additional file 3 for sample questions from the interview guide).

The interviews were transcribed. The analysis was performed by reading through the transcripts several times, identifying trends and organizing them into major themes. A literature review of academic articles, news articles and publicly available project documents were also used in the writing of the report.

Results and discussion

With the intention of exploring the varying perceptions of trust, a definition of trust was solicited from our interviewees by asking about their general understanding of the word *trust*.

The interviewees' responses identify the presence of trust as a criterion for a good relationship, in which there is assurance, honesty, support, transparency and truth-elements that lend confidence and stability to successful long-term interactions. Trust was also characterized as a type of contract demanding the fulfillment of partner roles that are clearly defined by written agreements and regulations that structure interactions. In addition, trust was understood as an outcome of participation in particular groups or well-executed processes, such as stakeholder groups or the research process.

Based on the results of this study, we have derived four key lessons – from which partners in other agbiotech PPPs can learn and use as a guide for building and fostering trust.

1. Participatory plant breeding sows success: a strong connection between research, industry and farmers promotes on-going dialogue within the project

Burkina Faso has built a strong cotton selling system that connects farmers' needs to researchers' abilities and

leverages the expertise of cotton companies. The initial partnership consisted of a collaboration between the Burkina agricultural research institute, INERA, Monsanto and Syngenta. Additional partners have also contributed their expertise, funding and platforms at different points during the project's development cycle.

Negative perceptions of Monsanto and GM crops

It is reported that Monsanto first approached Burkina Faso with GM crop information in 2000 to address the burden of pesticide resistance on the nation's cotton industry [7]. Field trials began in 2003 with a research agreement signed by Monsanto, Syngenta, and INERA. By 2007, Syngenta discontinued their involvement in the project, leaving Monsanto's Bollgard GM cotton crop to dominate field trials [8].

Skepticism grew over the potential consequences of such extensive private sector influence on Burkina Faso's cotton industry. One interviewee noted that negative perceptions of Monsanto arrived in Burkina Faso long before the introduction of Bt cotton. This negative perception permeated not only anti-GM communities but also the core partners themselves, who became highly suspicious of the motives and rationale for Monsanto's involvement in an agricultural project in Burkina Faso.

Recognizing motives, abilities and risks

Clear articulation of motives and risks was mentioned as an important trust-building practice to alleviate concerns pertaining to the development of PPPs. One researcher noted that a make-or-break factor in the success of the partnership was the candid disclosure of institutional motives early on in the project's development. In order for these national researchers to engage with new GM crops, any potential for risk had to be admitted in order for the partnership to proceed. It took various meetings for partners to feel comfortable with disclosing their institutional motivations, including the admission of profit-making motives. This practice improved transparency by opening channels of communication among partners, which helped alleviate suspicions and elevate levels of trust.

Collaboration is key

The interviews revealed that research in Burkina Faso is primarily funded not through grants from international organizations but through the sale of cotton on the international market. One interviewee reported that for every kilogram of cotton sold by cotton companies on the international market, one Franc is given to national research institutes. Through this exchange a vital connection is made among the farmers, research institutes and the commercial cotton companies. Interviewees associated the strong connection between the cotton research agenda and cotton farmers' needs to the funding relationship between cotton companies and national research institutes. Interviewees noted that the Burkina government had played a role in developing this funding relationship.

Our interviews also revealed that the farmers union, the Union Nationale des Producteurs du Coton de Burkina (UNPCB), held large stakes in the three major cotton companies: Société des Fibres Textiles du Burkina Faso (SOFITEX), Société Cotonnière du Gourma (SOCOMA), and FASO Cotton. One private sector interviewee noted that this arrangement gave the farmers a high degree of power in the cotton companies' affairs.

The case of Bt cotton in Burkina Faso demonstrates that the presence of a strong, inter-connected and collaborative partnership between industry, research and farmers has been invaluable in the development, implementation, and completion of the project. Levels of trust can be enhanced when there is a clear understanding of each partner's respective role, motivations, and contributions to the project. Furthermore, it is important to capitalize and build on pre-existing relationships and institutional structures as a means to establish and maintain trust in agbiotech PPPs.

2. Research is more than inquiry: researchers must collaborate with peers, journalists and the general public in a mutual and respectful relationship

Collaborative initiatives are most effective if a level of transparency is maintained through the timely dissemination of accurate and reliable information, the failure of which raises a key hurdle to project implementation issues pertaining to the public responsibility of researchers to communicate their findings.

Researcher disconnect

Researchers, sensitive to the volatile nature of public opinion toward agricultural biotechnology, were hesitant to speak to journalists about their scientific research and often directed journalists up the bureaucratic ladder. This not only weakened the informational content of communication strategies but also created unnecessary tension between researchers and journalists. Such a dynamic between the research community and the media works to limit civil society's access to appropriate and reliable sources of information on Bt cotton. Access to such information enhances transparency within the project and is imperative to the building of trust among all partners.

An issue that emerged as a challenge to trust building pertained not to the critical discourse over GM products but to the information that was used to substantiate these positions. A cotton company representative observed that much of the public discourse surrounding GM products was based on incorrect information. This incorrect information included beliefs that GM products will cause allergies, cause sterility and kill animals, to name a few.

Additionally, interviewees identified "activists" and "intellectuals" as groups strongly opposed to the project mainly due to a lack of reliable, scientifically-backed information on Bt cotton. The explanation offered for this highlights the intellectuals' disconnect from the

farmers' fields. A belief pervaded that these groups had not visited the farms to see the Bt cotton in context and, consequently, had limited understanding of the process. In this case, a lack of transparency and correct information reaching civil society groups and the general public resulted in reduced levels of trust.

Further limiting the progress of the project was a noted lack of public confidence in Burkinabè researchers at project inception. One journalist interviewed made a comment reflecting the prominent view in Burkina Faso that a poor country like Burkina cannot produce high technology. This perception exacerbated public doubts about the future success of the project. The widespread view of Burkinabè researchers as "incapable" also pervaded Burkinabè researchers' interactions with their international research peers. One Burkinabè researcher noted from his experience that trust was often limited when scientists from developed countries behaved as if their African counterparts were incompetent. When the project initially began, a Burkinabè government researcher noted that this dismissive view of Burkinabè scientists had to be addressed before the project could continue.

An additional challenge to trust building in this project was posed by external forces. In the case of Burkina Faso, external influences are comprised of both France and the United States providing direction on GM crops. Not only do France and the United States have differing views on the introduction of GM crops in Burkina Faso—the former being opposed and the latter being in favor—but the Burkinabè government is caught in the middle having to deal with the views of its own research institutes. The contradicting direction provided by such external influences not only left the Burkinabè government ambivalent about what course of action to take on GM crops in its country but also made it more reluctant to trust the scientists at its own research institutes. A researcher from INERA commented: *this [disagreement characterizing the external influences] created some confusion within the government and the research institutes, which were caught in the middle of these conflicting opinions.*

Each of these factors—the lack of collaboration between researchers and media, negative public perceptions, limited confidence in researcher capabilities, and external country influences—presented significant challenges to project implementation and highlight the many public roles researchers must play to successfully navigate PPPs.

"Seeing-is-Believing" seminars

In an attempt to disseminate research information and dispel popular myths and misconceptions about biotechnology, the Bt cotton in Burkina Faso project launched a communications campaign, of which the "Seeing-is-Believing" seminars were a component. In these workshops,

members from civil society were invited to the test fields. Attendees heard lectures on different topics related to biotechnology and were subsequently invited to visit the testing sites [9]. The "Seeing-is-Believing" seminars allowed all members of the general public to visit the Bt cotton trial sites and witness the growth of the cotton as well as engage directly with individuals in discussions about the cotton. According to farmers interviewed, it was an effective trust-building practice.

3. Tell them often, in many ways: communicators must recognize the reality of illiteracy and diversity by developing dynamic, multi-lingual communication strategies

The accurate dissemination of research findings and information on Bt crops is rendered meaningless without the implementation of effective and comprehensive communications strategies.

The importance of effective communication

One interviewee expressed a strong opinion that communications is the first step in building trust. A strong effort was consistently made to develop an effective communication strategy in Burkina Faso. This statement rings true in countries like Burkina Faso where diverse ethnic, linguistic, and educational backgrounds exist. Three different national languages in addition to French are spoken in Burkina Faso. However, Burkina Faso has an adult literacy rate of about 29% [10], rendering written information useless to a large segment of the population. This limits the various media outlets that can be employed and thus presents tremendous barriers to the effective communication of information on biotechnology to Burkina Faso's diverse population. It is therefore unsurprising that print media is viewed as having limited effectiveness. Likewise, interviewees also highlighted the often limited access most people have to a media outlet such as the newspaper and the difficulties of translating new and complicated concepts, such as Bt, into local language.

"Seeing-is-Believing": media, language and literacy

While French is the primary language of communication in Burkina Faso, many individuals speak ethnic languages such as Mooré, Jula, and Gulmacema. Despite these language barriers, members of the Bt cotton project were able to inform the majority of farmers about their project through the use of an innovative multi-lingual, multi-media approach. Interviewees noted that, for those who are literate in languages other than French, the government translated the GM law into native languages as well. Similarly, information about biotechnology was made available in different media forms including newspaper, radio advertisements, television promotions and films.

4. Follow-up at the field level: researchers and farmers must engage in open and honest dialogue to maintain trust

In addition to disclosing information to civil society groups and the general public, it is essential for farmers and researchers to maintain an on-going dialogue in which questions and concerns about the product can be expressed. Adequate quality-assurance measures and customer service practices from seed providers are imperative to acquiring farmers' trust and ensuring their compliance to the best farming practices according to the needs of the new technology.

Maintaining cotton seed quality

A significant challenge to the project's success was posed by a problem regarding the seeds' physical quality. A technical issue of smaller seed and poor germination emerged and affected trust between the partners and the farmers. Some farmers rejected the Bt cotton seed solely because of this issue. The farmer stressed that this lack of trust did not come from a lack of trust in the GM crop but rather in the seeds themselves. This demonstrates a need for ongoing communication between farmers and other partners, particularly researchers and seed providers, as well as a need for enhanced customer-service provision. Farmers' concerns must be identified and addressed to ensure the maintenance of trust and the success of the project. Other farmers called for more follow-up from researchers and the seed providers at the field level in order to clarify questions they had. This practice, according to the farmers, was critical in building or undermining trust between them and the seed providers.

Potential for greater seed quality-assurance practices

A government researcher echoed the need for greater seed quality assurance practices. He stressed the importance of improving seed quality assurance processes to ensure farmers receive the best ones available. One farmer suggested importing the Indian approach to addressing issues pertaining to Bt cotton. He reported that India, faced with similar issues, had introduced an annual international conference convening Bt cotton researchers. Through this effort, they were able to create an appropriate venue in which the problems pertaining to their national Bt cotton production could be addressed and solved. The ability for national, commercial and research actors to recognize and remedy this issue will play a significant role in the continued adoption of Bt cotton in Burkina Faso.

Conclusions

Burkina Faso's progressive cotton selling system laid the foundation for the implementation of this project – particularly, the strong dialogue and the receptivity to collaboration. It further demonstrated the importance of capitalizing on existing institutional structures and

relationships between industry, research and farmers. It is also important to recognize that researchers' roles are not limited to the lab. The challenge of establishing open, ongoing interactions between researchers and journalists must be addressed in order to disseminate accurate findings. Likewise, the generation of professional respect between Burkinabè and international researchers is essential for encouraging collaboration and information sharing, as well as assuring national and international confidence in Burkinabè research. Furthermore, the communication strategy of the Burkina effort attempted to reach as many people through as many means possible by including written, spoken and visual elements in several languages (including French and native Burkinabè languages), thereby broadening access to information as a means for building the foundations of trust. Although initial engagement with farmers and the public was noted as one of the strongest assets to the project, researchers' lack of follow-up on specific farmers' issues—seed germination problems, for example—led to broken trust with a number of farmers. Follow-up is therefore a critical element in seed adoption and the maintenance of trust among farmers, researchers and private companies. The lessons learned from this case study on Bt cotton in Burkina Faso can provide great insight to other agbiotech PPPs in sub-Saharan Africa. Interviewees reported that establishing and maintaining trust among partners, researchers and the community in Burkina Faso greatly contributed to the success of the PPP. By addressing challenges to building trust and engaging in trust-building practices early on, improvement in the effectiveness of agbiotech PPPs is likely.

Additional material

Additional file 1: Overview of the Bt cotton project.

Additional file 2: Roles and responsibilities of the partners.

Additional file 3: Sample questions from the interview guide.

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Authors' contributions

Study conception and design: OCE. Data collection: OCE. Analysis and interpretation of data: OCE and KB. Draft of the manuscript: OCE and KB. Critical revision of the manuscript for important intellectual content: OCE and ASD. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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