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Understanding the relations between farmers' seed demand and research methods: The challenge to do better

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Abstract

Although the development of improved seeds has witnessed significant advances over the last decades, the adoption of improved seeds and varieties by smallholder farmers is variable. This suggests that research methods for studying farmers' seed demand are not yielding information that reflects the real-life decisions and behaviours of farmers in the choice and acquisition of their seeds. We suggest that research methods for analysing farmers' seed demand shape seed availability. This is supported by the theory of social life of methods. We argue that access to and attractiveness of seed are highly context-specific for a farmer, for example, influenced by his/her social position, the role of the crop or variety in the farming system, the linkage to the market, agro-ecological conditions, and that context is highly variable. We also argue that many of our research methods are weak on capturing real-life context and provide fragmented snapshot-nature understanding and biases of farmers preferences and needs for seeds. We call for more integrated understanding of seed systems as a whole and a more holistic methodological research approach that better captures the variable real-life context of farmers while providing the metrics that are needed by seed actors and policymakers to enable informed decisions.

Keywords

agricultural technology, social life of methods, context, attractiveness

Introduction

Improved seeds[1] play a pivotal role in increasing agricultural productivity, improving farmers' livelihoods, and addressing the challenges of climate change and global food security. Yet, whereas there have been significant advances in the development of improved seeds over the last decades, their scaling into widespread use has been mixed (e.g. AGRA, 2018; Eriksson et al., 2018; Walker and Alwang, 2015). Significant challenges remain in achieving widespread adoption by smallholders farmers in low- and middle-income countries. Results of variety trait elicitations and preference rankings are increasingly used by breeding programs (e.g. Setimela et al., 2017; Witcombe et al., 2001). Nonetheless, use and turn-over rates of improved varieties often remain below expert expectations (Spielman and Smale, 2017). Many farmers still do not invest in high-quality seed (e.g. certified, Quality Declared Seed or otherwise guaranteed), even where such investments are seemingly available, affordable and profitable (Hoogendoorn et al., 2018). These mixed experiences lead to calls to redesign or align breeding pipelines in combination with more effective approaches to seed dissemination (Atlin, 2017; Eriksson et al., 2018; Rajendran Kimenye and McEwan, 2017) and increasing farmers' demand for quality seed (De Roo and Gildemacher, 2016). We reflect here on the role of one of the more commonly overlooked bottlenecks in attempts to make smallholder farmers plant more high-quality seeds: our research methods.

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The research methods and findings

Research to understand farmers' seed demand and context could help ensure that improved seeds are developed that align with farmers' needs and demands and enhance their subsequent diffusion. Recent studies, however, have pointed to shortcomings in the underlying research methods. More general shortcomings in research for agriculture and development include the lack of explanatory power (Kanbur and Shaffer, 2007; Shaffer, 2013; White and Phillips, 2012), biases in the problem definition (Stone and Flachs, 2014), the quality of the data collected (Fraval et al., 2018) and their use in the evaluation of impacts (e.g. De Janvry et al., 2011; Loevinsohn et al., 2012; Ton, 2015). As a result of assessment methods, concepts and variables chosen, we often may only have a partial, skewed or blurred understanding of what technologies work for which farmers (Crane et al., 2016; De Roo et al., 2017; Glover et al., 2016). On-farm trials are used to assess technology performance in farmers' conditions. Still, they can be poor predictors of actual farmer adoption of improved seeds because the trials do not fully capture the variations in crop growing conditions (e.g. Ronner et al., 2016; Van Vugt, 2018) nor consider the whole farming system (e.g. Pircher et al., 2013; Van Vugt, 2018).

There is a broad and evolving range of research methods from different disciplinary fields to elicit different aspects of farmers' preferences, motivations and demand for seeds. Some methods are relatively extractive, for example, formal surveys to estimate variety adoption and associated farmers characteristics, willingness-to-pay studies based on revealed preference or stated preference like contingent valuation and conjoint analysis, auctions and other experiments with games or real money. Other methods emphasize co-design and participation, for example, participatory breeding methods, rapid rural appraisal and farmer panels. Some of these methods have a quantitative orientation, others are qualitative or a combination of both. They can involve a large number of randomly sampled farmers to a few purposively identified individuals. The potential shortcomings of these methods vary. Participatory approaches often lack specification on how farmers were mobilized or who actually participated. Correlation in numerous adoption studies (e.g. between farmers' education and economic well-being and their use of improved seeds) does not imply causation: is the farmer growing improved seeds because (s)he can afford them, or is the better economic status an effect of using better seeds? The observation from the field of consumer studies that the different methods to assess willingness-to-pay may not be similarly functional for all product categories or for hypothetical products (Breidert et al., 2006; Grunert et al., 2009) is very relevant for 'seeds'. Smallholder farmers are often not familiar with these seeds (Misiko, 2013) and sometimes these seeds are even hypothetical. Moreover, farmers can usually plant seeds from alternative sources that may affect their 'willingness-to-pay': they can use on-farm saved seeds or seeds obtained from a relative or friend, and seeds are not necessarily paid for in cash or kind. Other researchers suggest that the applied methods for estimating farmers' seed demand are target-oriented tools for policymakers (e.g. Spielman and Mekonnen, 2013) and that there is not enough attention for the enabling environment (Orr, 2018).

When exploring farmers' preferences for seeds, typically farmers are visited by enumerators or invited to an experimental field. They are asked questions about the seeds they plant, the treatments they like best and which traits of the variety or treatment they consider most important. In the approaches that use vouchers or auction settings, farmers are asked to bid for or buy bags of seeds, sometimes in combination with other inputs. They use money that usually is given to them to spend on the provided options, which is hypothesized to reflect real-life choices once improved seeds have been developed. With the use of such methods, we eliminate a large part of the context from the equation: the picture we create of the farmers' preference is a snapshot taken from our perspective as researchers and devoid of trade-offs and considerations farmers have in a real-life situation.

Qualitative-oriented case studies have a strong value in increasing our understanding about the (im)possibilities of increasing farmers' demand for improved seeds; but they too have important weaknesses. Case studies usually are exploratory, meaning to show or question the social and socio-technical mechanisms at play, but they do not seek to be representative or to have high external validity (e.g. Maxwell, 1992). This leads, for example, to debates between scientists on the importance of local versus improved maize varieties in countries like Kenya and Mexico, see, for example, Hebinck vs Marines (Volkskrant, 2018) and Dyer vs Brush et al. (Brush et al., 2015; Dyer et al., 2014). The insights gained through case studies are thus relatively well-suited to generate critical understanding of the way context matters. However, they are weak on the external validity and not free of bias (Orr, 2012; Stone and Flachs, 2014). In addition, the information they generate is usually lacking the metrics that are needed by seed actors and policymakers to enable informed decisions.

The social life of methods

The notion that technology is shaped by society, and at the same time is shaping society, has started to permeate, including its related understanding that technology is not neutral (e.g. Bijker et al., 2012). Further drawing on the field of Science and Technology Studies (STS), this extrapolates in the argument that our scientific methods are not neutral tools either. The social life of methods (Law, 2009; Law and Ruppert, 2013; Savage, 2013) conceives research methods as simultaneously shaped by particular social contexts of researchers and actively shaping reality. In the case of research methods that capture farmers' demand for seeds, it means that they shape seed availability and their associated conditions. In the current situation, this represents a relation between researchers and farmers in which the researchers' views, through their methods, prevails. In addition, rather than capturing a pre-existing reality of farmer demand, the multiple methods represent varying

lenses, each highlighting a particular aspect of farmers' demand for seed from a particular angle. For example, willingness-to-pay studies enable farmers to display the behaviour of a market actor that takes rational decisions. Yet such purchasing decisions appear hypothetical for many smallholders as they imperfectly capture and therefore largely leave context out of sight. They may, for example, not consider farmers' behaviour as employers of landless labourers, as parents wanting to teach their children, or as good community members that feel the obligation to share with and/or use seeds. Most of our research methods are tailored within a context of agricultural development to measure adoption, impact on productivity, income, returns on investment, and so on. This focus leaves many other goals that may be relevant farmers out of our view and consideration. It should therefore be of no surprise that using and scaling the results of these different types of research have been mixed at best.

The contextual nature of farmers preferences and the triggering factor

We suggested that our research methods often do not sufficiently capture the contextual nature of farmers' technology preferences and needs, including seed. For farmers context matters, farmers do not only consider their entire farming system with different crop and livestock activities in their decisions but also consider their livelihood situation. Seasonal income from selling a harvest after a growing season of several months may be less attractive than a daily income from the milk of a dairy cow. A woman-farmer may actually prefer a high-input treatment from a demonstration trial, but such treatment may not fit her reality if she cannot decide in her household on the purchasing of the inputs. Micro-credit, if accessible, does not eliminate the risk of a crop failure in conditions with increasingly unpredictable rains (Tadesse et al., 2015). An input-voucher can typically not be spent on school fees. Soil fertility management and conservation is typically not attractive when you are a sharecropper and do not own the land (e.g. Saïdou et al., 2004).

In addition to the context being important, it is highly variable and affects farmers differently, even within a single community. For better-off farmers, new technologies can be highly attractive. They tend to have sufficient land to produce for the market, opportunities to mobilize capital and be less risk averse. They typically contract the labour of the poorer farmer households in their community for timely sowing and weeding, and they may be in the position to store the harvest and wait till market prices have improved. In contrast, the poorest households cannot afford a timely sowing or weeding of their land if they have to daily sell their labour to feed the family. The opportunity to find employment in the fields of neighbouring better-off farmers offers a level of food security, but also implies a high level of dependency, and eventually explains why conditions for using more productive agricultural technologies are less favourable or feasible for them. This creates a world in which the promoted technologies and market mechanisms can create interlocking social and economic (dis-)advantages, and mechanisms of reproducing poverty (Pircher and Almekinders, 2013; Cleaver, 2005). Most improved agricultural technologies may well unambiguously increase crop productivity, but their poverty alleviation potential is more contextual (Alwang et al., 2019; Frelat et al., 2015; Garbero et al., 2018). The rural poor also have other aspirations and constraints to deal with, and they do or cannot save and re-invest farm profits into a next season crop (Cleaver, 2005; Mausch et al., 2018; Verkaart et al., 2018). Even if they have interest in improving their agricultural production, participation in experimental trials organized by a development project may be too time consuming them: typically, women have many household chores and the least advantaged in our society usually have many other problems to deal with.

Finally, we assume that when we make quality seed available and accessible for farmers, they will actively pursue the acquisition of the new improved seeds. First of all, we are not sure how well farmers are informed. But even when informed, we expect farmers to act upon the information, by mobilizing financial means and traveling to an agro-vet shop to find the desired seed. This assumes their confidence in the promoted seeds and their willingness to invest financial resources as well as time and energy. Behavioural economics has questioned such willingness and ability to follow through (Duflo et al., 2011; Shah et al., 2012), thereby further questioning our understanding of farmers' decision-making. We may, for example, have a scenario where improved varieties seem perfectly aligned to farmers' seed demand with the right seeds available and accessible. Still even in such a scenario, our propositions may still not be convincing enough or not sufficiently attractive or maybe we simply need an additional trigger (or remove circumstantial blockages) to make farmers follow through on intentions. In any case, it means that preferences and demands as we measure them do not simply translate into an articulated technology need and use. Or, in other words, the research methods that study farmers' seed preferences are not yielding information that reflects the real-life decisions and behaviour of farmers in their seed choice and acquisition.

Towards a more integrated understanding of the seed system

When we acknowledge the snapshot nature and biases of our research approaches and tools, then the logical next question arises: how to better grapple with it? A first element of the answer is to assure we have a more integrated understanding of seed systems as a whole, and how these may differ between crops and countries, between and within contexts. A seed system focus encompasses more relevant contextual aspects of seed demand that inform real-life decision-making among farmers.

A systematic and integrated diagnosis can shed light on the functioning of seed systems–something attempted in two recent workshops. The first workshop characterized the strengths and weaknesses of the cassava seed system

in Nigeria (Almekinders et al., 2017). The participants were predominantly researchers. Through the analysis of seed flows and function of actors in the seed system they realized that the focus of their own work is on a particular part of the seed system only, without being familiar with the place of that part in the overall system. The second workshop diagnosed the constraints in the supply and access to quality seed of potato, maize and pigeon pea in Kenya (Beumer et al., 2018). The participants included a range of value chain actors who appreciated the cross-crop seed system analysis. The comparisons between crops and, associated with it, different agro-ecological regions and types of farmers showed similarities and differences; it provided participants more appreciation for the shared challenges of the actors in the seed value chains. One of those challenges that the actors identified was the need to more effectively connect among themselves to improve the information on what type of seeds should be made available and accessible for the different type of farmers in different parts of the country.

The implications and methodological solutions

A second element in dealing with the snapshot nature and biases of our research methods is to seek more holistic methodological research approaches. In relation to capturing farmers' contextualized preferences and needs, we need to bring together and seek their inter-connection and complementarity. To assess the value of their application, we may need to develop more dialogue-based relations among value chain actors, including farmers. We need to find ways to create dialogue-based relations with farmers to enable them to express what are desirable technologies for them in their particular context (e.g. seeds, associated inputs), how we should make these available to them and under which conditions they will actively pursue their acquisition and use. Only through such dialogue-based approaches, can we develop methods for studying farmer demand whose social life does not take precedence to researchers' views but effectively bridges the gap between the central objectives of agricultural technology programs and the variety of goals relevant for farmers in their specific contexts.

The experiences and insights from such interactions are inputs to further define and refine a methodological approach to studying and understanding farmers' choices in the use of seeds. Such a methodological approach would seek the combination of different perspectives, not only from different value chain actors and types of farmers but also from the different scientific disciplines. This therefore does not only call for more transdisciplinary but also for interdisciplinary work, which seeks systematic complementarity of approaches to better understand farmers' seed use. Obviously, such integrated approaches need to be institutionally enabled and supported. Dialogue-based relations can only become part of the normal-day practice when these value chain actors are organized and methodological integration requires researchers to critically reflect on their own research practices.

Conclusion

The advances in developing and diffusing improved seeds over the last decennia have been substantial. However, we see ourselves challenged to do even better, given the need to contribute to alleviate poverty and improve food security. This calls for better understanding the relations between farmers' seed demand and research methods. We need to recognize the flaws in our research methods that result in our generally fragmented snapshot-nature understanding and biases. This calls for a more integrated understanding of seed systems as a whole and amore holistic methodological research that better captures the variable real-life context of farmers while providing the metrics that are needed by seed actors and policymakers to enable informed decisions. But at the same time, we need to remain realistic about our expectations and ambitions to capture the complex and dynamic nature of farmers' reality. Still, these jointly will be a premise to arrive at more socially differentiated and attractive propositions for farmers. These can then be used to further align arrangements among other actors in the seed value chain and improve conditions of availability, accessibility and attractiveness of improved seed. This will affect, among others, priority setting in breeding programs and enabling policies around agricultural input supply and services such as microcredit and insurance. And more importantly, in the end, it should further enhance the development, uptake and impact of improved seeds to the benefit of smallholders in low- and middle-income countries.

Authors' note

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Note

1. Refers to crop propagation materials (botanical seeds, roots, tubers and/or other plant parts) with improved traits (e.g. genetic, sanitary and/or physiological nature).

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