THE VALUE AND POTENTIAL OF ON-FARM EXPERIMENTATION TO CATALYZE AGRICULTURAL TRANSFORMATION

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ABSTRACT

On-farm experimentation (OFE), which inculcates farmers' agency in knowledge discovery, has the potential to support and accelerate transformative agronomy at scale. The OFE process within the Nutrient-Catalyzed Agricultural Transformation in Africa (NUTCAT) project, encompasses farmer engagements, set-up of simple, easy-to-understand treatment designs, and contextual analysis of the data to enhance the relevance of the results to farmers. Ultimately, it is envisaged that this process will unpack the potential of precision nutrient management (PNM) to improve cereal system production. In this study we focus on the value propositions of OFE for maize-mixed systems of Kenya. To understand the value of OFE we applied the value proposition canvas (VPC) tool on three customer segment categories: Farmers, Service providers and Researchers. We also sought to understand how OFE could be embedded in existing agricultural innovation systems and contexts in which farmers operate. To this end, a survey was implemented to socioeconomically characterize Kenyan maize-mixed farming systems. In terms of the value of OFE, we find that maize farmers are the customer segment that stands to benefit most from the NUTCAT OFE. Farmers derive functional value in terms of high yields and income obtained, but also personal value which is realized through learning and internalization of agronomic concepts. It was observed that farmers value change processes that are holistic with targeted interventions across the value chain. This implies that for OFE to effectively take root in current innovation systems there is a need to explore several entry points beyond plant nutrition interventions. Analysis of the survey data shows that farmers operate under less-than-ideal conditions where fertilizers are costly and supporting institutional structures tend to be ineffective. For instance, although there have been efforts to provide subsidized inputs only a small share of farmers is accessing them. Nevertheless, at least a third of farmers seek and test for relevant solutions to overcome some of the obstacles they face in their farm enterprises. This goes to show that OFE can play a role in strengthening farmer agency to lead the innovation process and transform agricultural landscapes.

Keywords: Value proposition, on-farm experimentation, precision nutrient management

INTRODUCTION

The innovation system in Africa is still characterized by top-down or linear approaches that largely have stifled farmer agency thus contributing to agricultural stagnation. There has been an overt focus by Agricultural Research for Development (AR4D) organizations to prescribe blanket nutrient management recommendations to beneficiary farmers (Zingore at al. 2022). A substantial amount of participatory work has been done with farmers to understand underlying driving factors

to their decision-making, but this is yet to bear fruits in terms of increasing their innovative capacity. On-farm experimentation (OFE) is disruptive to this counter-productive process as it brings agricultural stakeholders together around mutually beneficial experimentation to support farmers' own management decisions (Lacoste et al. 2022). Given that OFE is farmer-centric, farmers are not only passive recipients of technologies but are also experimenters, hence are central to the innovation processes. The experiments are conducted at scales that include effects of variations and mimic local conditions as far as possible (Cook et al. 2018). In addition, OFE is characterized by evidence-driven (standardized data protocols), expert-enabled (added value through scientific engagement), co-design (of experiments), and scaling by co-learning (sharing of data, insights, or ideas) principles (Lacoste et al. 2022).

An introspection of the relevant literature ascribes value of agricultural technologies in terms of productivity and household income. There is evidence that technologies such as fertilizers and improved seeds have contributed significantly to increased productivity or incomes of smallholder farmers (Khonje et al. 2015). Nevertheless, the supposed benefits of these technologies have still not been adequate to support their widespread adoption. An interesting perspective is drawn from the re-definition of 'value' by Christensen et al. (2016). They define the value of a product or service as the ability to accomplish the intended task of the beneficiary at a specific point in time. Instead of focusing on the attributes of the beneficiary or 'customer', it is more crucial to concentrate efforts in establishing what the 'customer' hopes to accomplish. Hence, borrowing from this definition we define 'value' as the ability of OFE to enable farmers (or other beneficiaries) to complete 'jobs to be done'. This paper explores the value propositions of OFE for maize-mixed systems of Kenya to understand the value of OFE to different customer segments (farmers, service providers and researchers) and how it could be embedded in existing agricultural innovation systems.

MATERIALS AND METHODS

The value proposition canvas (VPC) was used to garner data on the value of the OFE process from the perspective of the farmers, service providers and researchers (Osterwalder et al. 2015). The value proposition (VP) concept and set of tools is aimed at creating products and services that customers want. In our case the 'customers' were i) farmers who participated in the OFE process and those that were not a part of the process; ii) service providers, mainly the extension agents, non-governmental organizations and any other actors involved in sharing information and knowledge; and iii) researchers drawn from academia and international organizations. The VP is a useful methodology and approach that furnishes tools to help in creating value for the customers, helps us to learn what customers want, trains focus on customers rather than on technologies, products and features, and helps one work with clear processes and tools. Hence, the VPC consists of the customer profile ('understanding your customer') and the value map ('how to create value for the customer'). Finally, you try to see where the two parts fit.

A one-day workshop was organized in September 2023 that brought together different 'customer' segments to ascertain the value they derived from the OFE process. The participants were taken through the tool so that could effectively partipate in the exercise. This was followed by interactive sessions with participants in the late morning and early afternoon sessions where the customer profile was defined, the value map described and finally the value proposition for OFE determined and reviewed (Figure 1). The forty-one attendees included 15 farmers with the rest drawn from 9

organisations including OCP-Africa, APNI, Kenya Agricultural Livestock Research Organization (KALRO), Tupande by One Acre Fund, Cereal Growers Association (CGA), University of Nairobi, Pwani University, County Government extension, and the Alliance of Bioversity and CIAT.

RESULTS AND DISCUSSION

The beneficiaries or customer segments of NUTCAT OFE were categorized into four: i. NUTCAT farmers ii. Non-NUTCAT farmers iii. Service providers iv. Researchers. On application of the VPC tool, it was clear that farmers were the main beneficiaries, but with service providers and researchers benefiting as well albeit to a smaller extent.

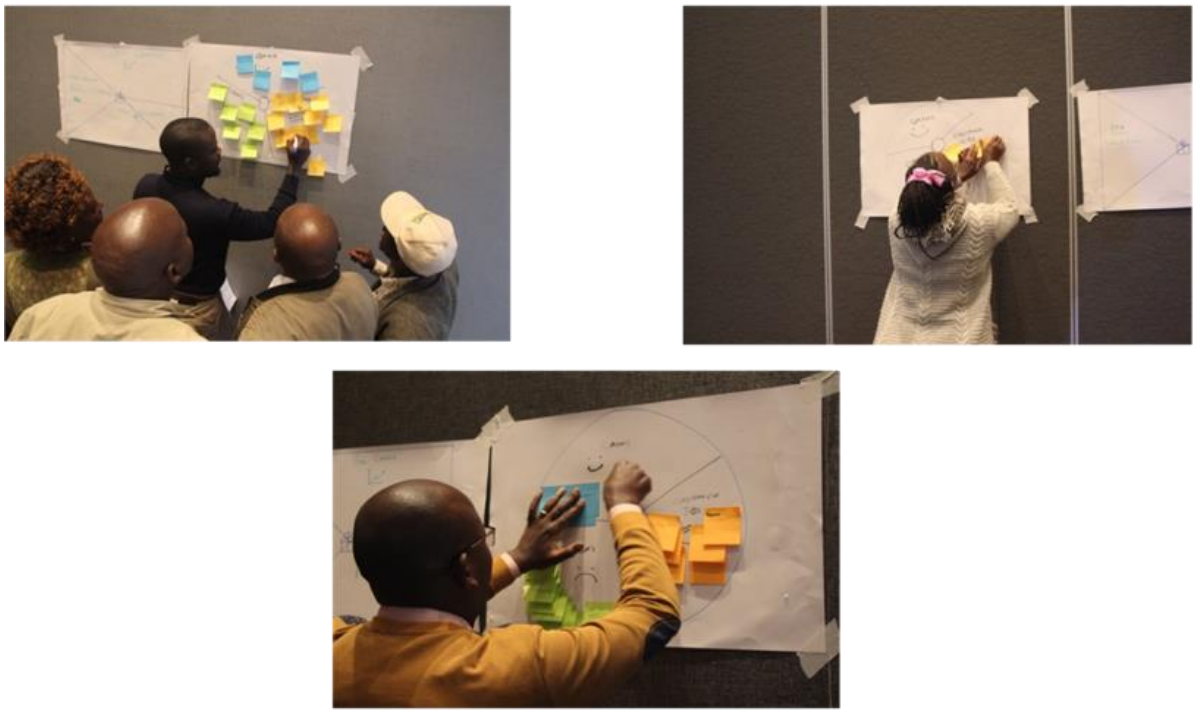

Figure 5. Interactive session to define customer profiles of service providers (top left), farmers (top left) and researchers.

In terms of gains, for farmers functional gains were the most important. Farmers learned from the OFE process on best management practices e.g., crop density, proper use of fertilizer. Farmers valued the higher income earned because of increased productivity. They were well motivated to continue their farming enterprise due to anticipated yield increases. For instance, one NUTCAT farmer reported getting a revenue of US$ 1500 from maize sales. Farmers derived personal value from NUTCAT OFE given that they were able to learn and internalize new agronomic concepts ultimately building their human capital. This is important as it improves the management skills of farmers enabling them to be more adept at innovating. Also, personal value was derived when there was an improvement in social status. Farmers, for instance, indicated that one gain from the OFE process was an increase in social standing in the community as they were able to pay their children's school fees or go to good hospitals.

In terms of inputs and treatments, the inputs OFE works with included fertilizers (DAP, CAN, MoP, Urea, Urea-S, Urea-S Zn), hybrid seeds (Pannar, Duma, DK8033, DK8031), farmyard manure, herbicides, and pesticides. The treatment OFE works with was precision nutrient management (PNM), which emphasizes the efficient and appropriate use of fertilizers. It ialso focuses on site specific nutrient management considering spatial (and temporal) variability. There is also the aspect of sustainable intensification that includes elements of soil and water conservation e.g., use of furrows, and integrated soil fertility management (ISFM). The intent of the OFE process was to increase efficiency of applied inputs through the application of PNM, which in this case is undergirded by 4R Nutrient Stewardship principles i.e., using the right fertilizer source, planting at the right time, right rate, and using the right application method. Substitution took place as well with farmers having stopped using recycled seeds and now using certified, high vigour ones. There was also the intent to redesign the farming system using soil and water conservation technologies to help conserve soil moisture. From a science standpoint, the OFE process entailed the collection of agronomic data (mainly crop cuts). Agronomic principles are adhered to especially where the input of the scientist was prominent. This would entail use of hybrid seed varieties, recommended spacing (crop density), gapping, weed control, and pest control. These agronomic practices were documented for both the scientist-led (OT) and the farmer-led (FP) treatments. All the sampling points (9-36 per field) for the crop-cuts were georeferenced. This was important for garnering spectral data that could be used to generate imageries and yield maps and be correlated analytically with measured yields.

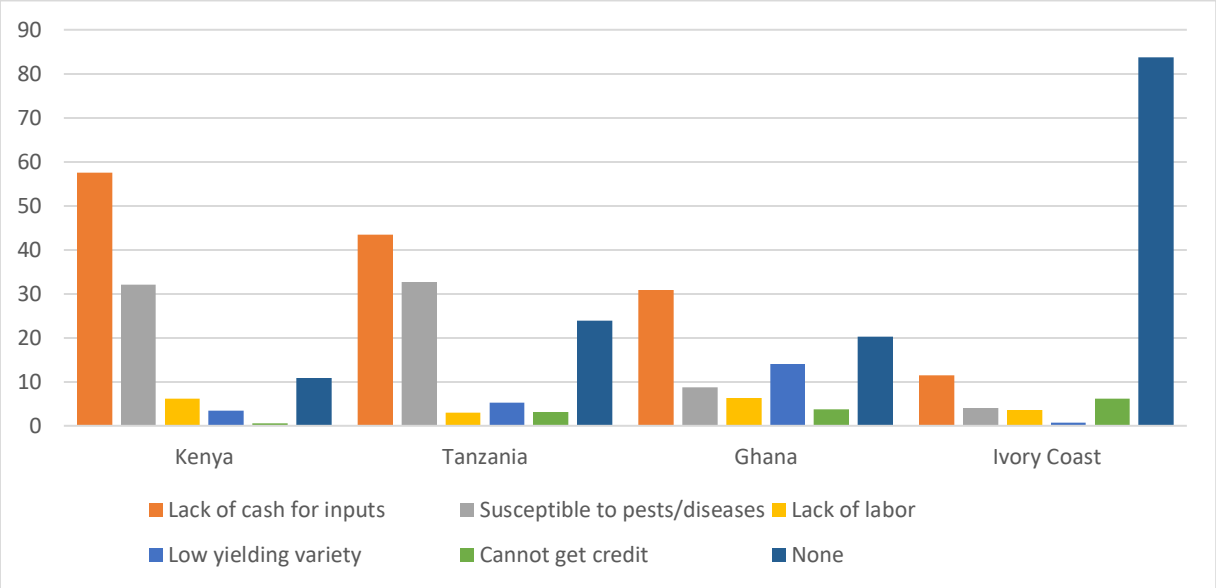

Figure 6. Major farm constraints across countries.

Social or qualitative data is collected at engagement events with farmers and other stakeholders e.g., post-harvest dialogue meetings. Focus group discussion check lists and interviews are applied. Monitoring is done throughout the season to track farmer learning and uptake of innovations. Detailed surveys were also conducted to unravel the socio-economic context in more depth. Key survey results show that farmers operate under less-than-ideal conditions where fertilizers are costly and supporting institutional structures tend to be ineffective (Figure 2). Despite efforts to

provide subsidized inputs only a small share of farmers are accessing them. Nevertheless, at least a third of sampled farmers are experimenting with various options to overcome some of the obstacles they face in their farm enterprises (Table 1).

Table 5. Level of farmer-led experimentation and knowledge generation in Kenya.

Experimentation	
Farmer experimenting /testing solutions (%)	28.10%
Farmers have sought for solutions (%)	33.10%

CONCLUSIONS

The OFE process in principle portends substantive value for farmers. Nevertheless, OFE has not addressed financial literacy and record keeping needs of farmers. This is important if they are to derive maximum value from the process as they need to know if their farming enterprise is profitable. There other issues related to translational uncertainties e.g., access to good, certified seeds that need to be addressed to further unlock OFE. There is need to strengthen extension given the high farmer to extension ratio. Gender streamlining, which is important for service providers and researchers, may have a positive spillover on the OFE process. Government support is crucial for researchers to derive benefits from an OFE process and to alleviate some of the infrastructural constraints that generally hinder the change process.

REFERENCES

Christensen, C.M., Hall, T., Dillon, K. and Duncan, D.S., 2016. Know your customers' jobs to be done. Harvard business review, 94(9), 54-62.

Cook, S., Lacoste, M., Evans, F., Ridout, M., Gibberd, M., and Oberthür, T. 2018. An On-Farm Experimental Philosophy for Farmer-centric Digital Innovation. Proceedings of the 14th International Conference on Precision Agriculture.

Lacoste, M., Cook, S., McNee, M., Gale, D., Ingram, J., Bellon-Maurel, V., MacMillan, T., Sylvester-Bradley, R., Kindred, D., Bramley, R., Tremblay, N., Longchamps, L., Thompson, L., Ruiz, J., García, F. O., Maxwell, B., Griffin, T., Oberthur, T., Huyghe, C., … Hall, A. 2022. On-Farm Experimentation to transform global agriculture. Nature Food, 3(1), 11–18. https://doi.org/10.1038/s43016-021-00424-4

Khonje, M., Manda, J., Alene, A.D., and Kassie, M., 2015. Analysis of adoption and impacts of improved maize varieties in eastern Zambia. World Dev. 66, 695–706.

Osterwalder, A., Pigneur, Y., Bernarda, G. and Smith, A., 2015. Value proposition design: How to create products and services customers want. John Wiley & Sons.

Zingore, S., Adolwa, I.S., Njoroge, S., Johnson, J.-M., Saito, K., Phillips, S., Kihara, J., Mutegi, J., Murrell, S., Dutta, S., Chivenge, P., Amouzou, K., Oberthür, T., Chakraborty, S., and Sileshi, G.W. 2022. Novel insights into factors associated with yield response and nutrient use efficiency of maize and rice in sub-Saharan Africa. A review. Agronomy for Sustainable Development, 42, 82.