Identification, Evaluation, and Selection of Products and Practices for the Post-Harvest Sector: Evidence from Decision Makers in Tanzania

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Report at a Glance

Background

The sub-Saharan African post-harvest sector has been a target of substantial investment in the past decade. Post-harvest interventions are typically designed to improve household food security and safety, value chain actor livelihoods, and resource use (Sheahan and Barrett 2017). In Tanzania alone, a range of donors, international and local organizations are involved in ensuring better products and practices are available and accessible to farmers for storage of crops post-harvest – and that they themselves are using the best extension products and practices to reach farmers. In this study, we focus on decision makers – the individuals within international or non-governmental, grantmaking, or implementing organizations who have the ability to influence which products or practices are included in their organization's post-harvest sector programming.

Question

While there is increasing evidence surrounding farmers' decisions to adopt post-harvest sector products or practices, there is still limited evidence surrounding decision makers' strategies to identify, evaluate, and select products or practices for post-harvest sector programs. More evidence is needed in this area because ultimately these decision makers are who determine which products or practices are available to farmers through programs. This study generates evidence to answer two related questions:

- How do decision makers identify, evaluate, and select different products or practices for their post-harvest programming?
- How do decision makers access product or practice information (e.g. external evaluation) that feeds into the "identify, evaluate, and select" decision process?

Methods

This study uses qualitative coding to annotate and draw connections among interview transcripts from eleven semi-structured interviews with decision makers from organizations involved in the Tanzanian post-harvest sector. This allows us to systematically identify differences across decision maker experiences and understand relationships among factors that affect decision-making.

Findings

We find information related to products or practices flows from donors to international non-governmental organizations (INGOs) and local non-governmental organizations (NGOs), and

find that activities like stakeholder meetings and conferences enhance these flows. There is also evidence of information flows, such as about identified products or practices, from INGOs and NGOs to donors. Our results also indicate that many organizations still use field tests to collect information about the performance of different products or practices. However, we also find that these tests have multiple purposes: to determine performance, as well as engage government and farmers, and assess availability and/or the logistics of providing a product. Providing better technical performance data collected and shared by donors, for instance, might not serve some of these purposes well, such as engaging stakeholders, but they could enable evaluation to be conducted at larger scales earlier in a program.

We also find that many organizations provide a "menu" of options of products or practices to farmers, emphasizing that it is not their role to select one particular product or practice for farmers. However, by developing that menu, organizations shape a farmer's decision space – from never identifying a product or practice in the first place, to eliminating one from the menu after poor performance during field trials.

Introduction

The Comprehensive Initiative on Technology Evaluation (CITE) at Massachusetts Institute of Technology (MIT) is dedicated to developing methods for product evaluation in global development. CITE is led by an interdisciplinary team at MIT, and draws upon diverse expertise to evaluate products and develop a deep understanding of what makes different products successful in emerging markets. Our evaluations provide evidence for data-driven decision-making by development workers, donors, manufacturers, suppliers, and consumers themselves.

This study seeks to uncover how post-harvest interventions can be designed to improve household food security and safety, value chain actor livelihoods, and resource use (Sheahan and Barrett 2017). The study represents an extension of CITE's previous work on post-harvest technologies in that here we analyze the organizations and programs that enable products and practices to reach the world's poor. The sub-Saharan Africa post-harvest sector has received substantial investment in the past few years. In Tanzania, the Rockefeller Foundation's YieldWise initiative – a $130 million effort aimed at reducing post-harvest loss in sub-Saharan Africa by 2021 – began operations in 2016. The World Food Programme's Patient Procurement Platform, an effort to have smallholder farmers grow and supply food for assistance programs, is addressing questions of post-harvest loss and agricultural input and market access. USAID- and other donor-funded projects are working with firms along the value chain to improve post-harvest processing. In addition, the Gates Foundation-funded Purdue Improve Crop Storage (PICS) network is active in Tanzania.

As part of this work, the Global Knowledge Initiative (GKI) is supporting a range of stakeholder decision making in the Tanzanian sector. GKI creates an enabling environment, the mindset, and the tools for collaborative innovation. A set of tools that they developed for these stakeholders motivates this study: we aim to provide evidence of how decisions are made in the sector, in order for them to best deploy their toolset.

These post-harvest sector activities are supported by a body of evidence on the factors that affect a farmer's decision to adopt technologies or practices in the post-harvest storage sector. Bokusheva et al. (2012) find that the desire for household self-sufficiency as well as socio-economic characteristics such as age, land ownership, and completion of a training course determine adoption of post-harvest storage products. Prusky (2011) cites the cost of the product as a determinant of adoption; likewise, Addo et al. (2002) find cost as the major barrier to adoption of integrated pest management products and practices. Other studies of post-harvest products and practices offer analyses of their impact on household food security (e.g., Abass et al. 2014) as well as the barriers to their intended use (e.g., Burke 2014), most of which at least affect farmers' adoption decisions. It is important to note that there is still mixed evidence on the actual magnitude of loss and the most appropriate responses to it (Affognon

et al. 2015; Sheahan and Barrett 2016).[1] While the post-harvest community is beginning to understand how farmers make choices among available products or practices, there is little evidence about the processes used by decision makers in organizations that affect – either directly or indirectly – the products or practices to which a farmer has access.

For this study, we consider individual decision makers in organizations who have the ability to influence which products or practices are included in their organization's post-harvest sector programming. In this case, we focus primarily on the products or practices used in the actual programs, such as special bags or drying techniques, but also consider the products or practices used to deliver the programs, such as extension pedagogies. These decision makers are often program managers, grant managers, and technical staff, or directors of smaller, local NGOs. In designing interventions to introduce better products or practices, a decision maker has to both identify options (i.e., diverging) and thoughtfully evaluate them to select top candidates (i.e., converging). This design process can happen within one organization or between multiple organizations.

This study aims to understand how decision makers identify, evaluate, and select which products or practices are made available to farmers in Tanzania. Specifically, we ask:

- How do decision makers identify, evaluate, and select different products or practices for their post-harvest programming?
- How do decision makers access product or practice information (e.g. external evaluation) that feeds into the identify, evaluate, and select decision process?

This study draws from data from eleven interviews, analyzed through qualitative coding, in order to answer these questions.

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[1] And thus, while the post-harvest context is certainly unique, many of the insights that we generate from a study of the post-harvest sector apply to other sectors.

Methods

Study Design and Data Collection

We gathered qualitative data via semi-structured interviews with decision makers in Tanzanian organizations who identify, evaluate, and select products and practices for inclusion in their agriculture, and specifically post-harvest loss, programs. We developed the interview questionnaire based on the Improved Innovation Decision-Making Toolset (Rose et al. 2017), a guide developed as part of the Rockefeller Foundation YieldWise initiative by Global Knowledge Initiative (GKI). Specifically, we use the Decision-Making Toolset to develop and organize a set of interview questions that capture the decision making process from identification to selection. The toolset serves as a resource to (1) cultivate the "innovator's mindset" and (2) enhance the processes that support improved decision making along the journey from idea to impact. GKI had conducted a literature review in developing this toolset (partially presented at the introduction of the Toolset), which presents 14 tools and describes an enhanced process for generating insights, reframing challenges, developing and testing new ideas, and determining a course of action. The toolset has been used in seven rounds of training conducted by GKI as of

July 2017, and its insights are applicable for decision makers in research, industry, government, and civil society.

We used a purposive, snowball sampling method to identify interviewees (Fowler 1998) and conducted interviews with individuals in multiple organizations across Tanzania.[2]

In total, we interviewed fifteen stakeholders from the Tanzanian agricultural sector over three weeks in January 2017. All interviews were conducted in English. We interviewed these stakeholders in four Tanzanian cities – Dar es Salaam, Iringa, Arusha, and Dodoma. We conducted three follow-up phone interviews after returning to the United States. In total, we interviewed eighteen individuals. Each interview lasted between 30 minutes and one hour.

We gathered less data about the decision-making timeline and participants than we anticipated. We found that questions about the timeline and participants were non-trivial; they required a deep understanding of the project and organization, much like questions related to activities and criteria. Because we used snowball sampling – and thus had somewhat tenuous introductions to stakeholders – we had difficulty exploring multiple deep topics in the limited amount of time that we had with each interviewee. Accordingly, soon into fieldwork we prioritized collecting data related to the activities and criteria involved in the three steps of the decision-making process over collecting data related to the timeline and participants.

Study Analysis

We use coding to analyze the qualitative data gathered in the interviews to retrieve and categorize data that are similar in meaning, thereby developing themes to answer the research questions (e.g., K. M. Eisenhardt and Graebner 2007; George and Bennett 2005). Specifically, we use Atlas.ti software to code and annotate the interview transcripts, allowing us to systematically identify relationships among factors that affect decision-making. Analysis methods from operations management (Eisenhardt 2007) and social sciences (George and Bennett 2005) are used. We code each set of interviews twice, subsuming and creating new codes in the second round; coding interviews multiple times is standard practice (George and Bennett 2005).

Of the eighteen participant interviews conducted in the study, transcripts from seven were excluded from final analysis. In four cases, this was because it emerged that the participant held a role tangential to the programmatic decision-making process regarding agricultural products or practices. The remaining three participants excluded from the analysis were directors of large organizations provided useful background information, but – by virtue of their position – typically could not share direct, personal experience of that of a mid-level individual decision maker. These are presented in Table 1.

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[2] This method has recently been deployed in a recent study related to individuals working in nutrition-oriented programs elsewhere in East Africa (e.g., Warren and Frongillo 2017).

Table 1: Interviewees Titles and Organization Types of Analyzed Transcripts

Organization Type	Title	Organization Type	Title
Tanzanian Government Sponsored Organization	Program Manager	Local NGO	General Manager
INGO	Post-Harvest Specialist	Local NGO	Project Manager
INGO	Product Innovation Lead	Local NGO	Field Coordinator
INGO	Project Officer	Local NGO	Deputy Chief of Party
INGO	Agriculture Specialist	Local NGO	Director
INGO	Project Manager		

Results

Coding and Emergent Categories

Initial codes for the analysis were primarily developed to probe the three steps of the decision-making process: identify, evaluate, and select. Upon review, it became apparent that we needed to distinguish between activities (e.g., consult other organizations) and criteria (e.g., cost of a product) used across the three steps of the decision making process. These groups of codes, and the actual codes within them, emerged from analysis. Thus, during the second round we coded for activities and criteria. We present the count of decision makers that referenced each activity or criteria in Table 2 and Table 3, respectively.

Table 2: Count of Decision Makers Mentioning Each Activity

Activities and Associated Counts					
Identification	Count	Evaluation	Count	Selection	Count
Consult other organizations	10	Test in field	7	Present "menu"	5
Use internal or external experts	3	Work with farmers	7	Engage government (later)	2
Operationalize donor work plan	3	Test in lab	3	Engage supply chain actors	2
Attend conference	2	Desk research	2		
Review journals	2	Develop consensus among partners	1		
Consult other offices of the same organization	1				
The count in this table is of decision makers in organizations.					

We present working definitions from the codes presented in Table 2 in Appendix 2.

Table 3: Count of Decision Makers Mentioning Each Criterion

Criterion	Count of decision makers
Cost	8
Quality outcome	7
Availability	6
Cost-benefit	5
Logistics of providing	5
Amount of crop	5
Added benefits	3
Large institutions and firms	3
Government approval	1

- We present working definitions from the codes presented in Table 3Table 2 in Appendix 2.

Identification decisions

First, we address how decision makers identify different products or practices for their post-harvest programming. Overwhelmingly, ten out of eleven organizations identify other products or practices from other organizations: I/NGOs, government, donors, and firms. Regarding identification, one interviewee from an INGO noted:

> *Initially we do 60% insight and 40% outsight, so outsight being looking at other [INGO] countries and products and then also looking generally.*

Note that insight refers to searching for products herself, outsight refers to looking at other countries in which the INGO works.

Another noted that subject matter experts play a role regarding which specific products to order:

> *We talk them the specification, whatever, so farmer they can give their opinion. We can give [the farmer's] opinion. Even the manufacturer can give [a] technical opinion. We don't have much knowledge of that.*

Many interviewees also found that the work plan, which donors, INGOs, and local NGOs often jointly draft, serves as a source of products or practices for programs. Discussing how they identify practices, one interviewee notes:

> *So we go and create a curriculum and a guideline on how to prepare this. […] And then you have to adapt them sometimes. We just take all this from other areas where they have already done this. So we come up with a good, you know, training package that people understand. But it depends what is written in the proposal.*

Many also defended their autonomy to make decisions; the work plan does not dominate all decision making. One interviewee from a local NGO notes:

> *They just give us an idea. They just give us an idea and give us room to give suggestions. If they see it is not working properly they say, 'what is your plan?'*

Conferences, journals, and experts – all sources of targeted, technical information – can play roles in identifying products or practices. One interviewee at a Tanzanian sponsored organization recounted, regarding practices:

> *So we want to do activity ABC, what do you think what do you think what do you think, and then we come up with a plan: okay, let's do this approach. If it is out of our control, we can hire a consultant who knows [nutrition and agriculture] very well and can come up with a proposal.*

Not many decision makers consult individuals in other offices in the same organization, which could indicate a reliance on other organizations in the same context than the same organization in a different context, or limited interactions between the multiple offices of the same organization. Like with timeline and participant data, we considered collecting data on interactions between multiple offices of the same organization to be able to control for this effect in our results, but collecting that data proved more time consuming than we had anticipated.

Evaluation decisions

Next, we explore how decision makers evaluate different products or practices for their post-harvest programming. Experimentation features prominently in the evaluation process, with field tests being more common than controlled, lab tests. One interviewee notes:

> *We are not testing that technology at the office. We are testing technology at the village where there is farmer, you know. And then during the testing all farmers, in that particular village, they are invited. During the process of closing and the process of opening, you know. We also invite government [officials] who are around those areas at the district and the regional level and the other stakeholders whom we are working together with.*

Field tests serve other purposes, in addition to generating data on how well a product or practice works, it can reassure the organization and government of the effectiveness of the product or practice, as well as give an indication of how farmers perceive the product or practice and how well it would be received should it be selected. For instance, one interviewee from a local NGO noted:

> *In the first place farmers did not want to buy these technologies because they said they were very expensive. So we had to use the trials in order to convince them. Farmers did not want to risk them and buy something without proving the results.*

One organization – a local NGO – did give a threshold that they, instead of the farmers, have for data related to performance:

> *I would say [local NGO] in itself doesn't want to promote things that are highly untested and questionable. We're not overly limited to proven by the scientific community, but by the development community is enough.*

At this stage in the decision making process, the cost and the benefit (i.e., quality outcomes or added benefits, as defined above) feature prominently in the decision making process. An interviewee from a local NGO focused on performance said:

> *Successful technology is the most important. If it's not effective, don't promote it. After that, cost…and labor, especially women, and child labor, they are criteria…they have been maxed out already.*

One interviewee from an INGO who was focused on cost noted:

> *The approach was to look at very simple post harvest technologies that are affordable for smallholder farmers. Some of the technologies we are looking at for example are demonstrating the use of shade, adaptive cooling, improved packaging. It was clear that those were very simple technologies that could be adopted by smallholder farmers.*

Another interviewee from an INGO noted, almost identically:

> *We looked at the performance of the [product], in other words what is the quality of the product coming out after it's been handled […]. And then we looked at the cost later on when we were doing the business plan.*

Selection decisions

Finally, we describe how decision makers select products or practices for their post-harvest programming. Almost half of the interviewees referenced the concept of presenting options to a farmer instead of just one product or practice – in many cases this was referred to as a "menu" or "set of options." One interviewee from an INGO said:

> *For us, we don't want to be a solution provider. We want to give farmers a menu and let them choose what is best for them. And how we do this is we organize demos on the farmer level.*

Another interviewee from a local NGO noted:

> *Of course, we are not the one who decides. The final consumer decides, they are the ones who decide. So after, we are not selecting which product to advertise but we treat all stakeholders in the post-harvest technology in an equal way.*

It is important to note that while they often present a menu to a farmer and let them make the final decision based on whatever criteria they find important (e.g., cost given access to credit, amount of food they harvest), implicitly they make the penultimate decision using criteria and decide what to present to the farmer. This is an important aspect of the selection process. In other words, they do still constrain the farmer's decision space, using the criteria that they think appropriate.

As decision makers are selecting products or practices, government and its perception and understanding of them begin to play a role. Our interview guide did not include questions about the role government played in decisions, but unprompted several interviewees brought it up. For instance, an interviewee from a local NGO noted:

> *When we are doing the unveilings [of hermetic storage products], what we do is we invite the local government officials, even the regional officers to come to witness the results alongside the farmers.*

At this stage of the decision-making process, the logistics of providing the product or practice and/or the availability of the product feature prominently in the decision-making process. In some cases, we find which organization cites which criteria are important in making this decision can be inferred by their program model. Generalizing each organizations' activities, there are two types of programs that organizations run. In one type, the organization provides direct support to farmers, e.g., chartering trucks for transporting a product. In the other type, the organization provides indirect support to farmers, e.g., working with retailers to stock a product to be sold to farmers. In other words, we observe that organizations that partake in providing farmers with direct support consider the complexity of providing farmers with that direct support, and those that do not provide direct support consider the ability of other firms to provide farmers with support – while we would expect this, it is reassuring to confirm it with the data. This distinction is shown in Table 4.

Table 4: Selection Criteria for Different Program Models

Criterion	Count of decision makers from direct support organizations[i]	Count of decision makers from indirect support organizations[ii]
Logistics of providing	4	1
Availability	2	4

Organizations that consider the logistics of providing a product or practice often use program models that include providing direct support to farmers. One INGO that plays an active role in delivering products to farmers reported:

> *Plastic silos, for the logistical complexity to be worth it, I would have to show a pretty massive impact. I would have to show that we could make margin on that*

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product that may need more trucks or need to do a ton of installation or if we thought that the, I feel like I have – I together with the team that I work with – we have a pretty good understanding of what product complexity I think our farmers without training are comfortable to do.

On the other hand, organizations that consider availability use program models that include working with private firms in order to provide indirect support for farmers. One interviewee from an INGO that works closely with firms observed:

The reason we use local manufacturer is because then they are easily available to local people once we identify them.

Few interviewees explicitly discussed revising their selections. However, one INGO interviewee did explain that they did revise the products considered in their programming:

We tried it right, so the farmers are not interested. So when there is no market that means there is no market for the agro-dealers. So it's eliminated.

Accessing information to support decisions

In the identification stage of the decision-making process, interviewees often cited identifying products or practices from other offices from within the same organization or other organizations. An interviewee from an INGO notes:

So when we have those meetings, people say, you know, this new product coming in, that's how we hear about this, and if interested we follow up with that.

His colleague confirmed:

Sometimes it happens when we have the partners meeting. Some ideas are coming from partners. For example, the approach, maybe we have planned to go one way and they suggest another way.

Another interviewee from a local NGO similarly noted:

Even now, when we met last week with the stakeholders meetings in [location] we agreed we were going to introduce the [product]*. They gave me one sample.*

And her colleague, at another local NGO, concurred, reporting the same thing:

We had a stakeholder meeting in Dar […] So that's where we discovered there is the other [product]*.*

However, some interviewees did identify products themselves though farm visits and searching on the Internet. Referring to a product she saw on a farm visit, one interviewee from a local NGO said:

So we have one company in [location]*, which is called* [brand] *who is manufacturing this maize sheller. But I heard that there is Chinese made maize sheller. So I was looking on the Internet to see where is this from, apart from the one manufactured in* [location]*.*

In contrast to the identification stage, at the evaluation and selection stages of the decision-making process, interviewees indicate that organizations use information that they collect themselves. For instance, despite being an implementing partner for many large donors who have ready access to information on the performance of the products involved in the intervention, one interviewee at a local NGO noted:

Through that testing it proves that this technology it can be proper to the farmer so after realizing that this technology is working, we need to work together, we need to collaborate with other manufacturers, stakeholders, so that we can promote that technology to reduce the also for the farmer. We normally test it. […] So we test it, we don't want to give farmer things, which we have never tested.

This approach to testing is echoed by an interviewee at a large INGO:

And, of course, to address that to farmers we did some testing where we placed the maize into the metal silo and the plastic can. We did the research on it where we compared the metal silo, the plastic, the poly, and we finally realized that they are all three good.

Discussion and Recommendations

Our results indicate that information about different products or practices, such as available and affordable product types and manufacturers, flows between donors, INGOs, and NGOs. In this discussion, we consider upstream organizations to be donors and other organizations with convening power and downstream organizations to be INGOs and NGOs. All are decision makers. We find that activities like stakeholder meetings and conferences enhance the flow of information between the organizations. In other words, most interviewees did not report independently researching which products or practices to use in their programs. However, our results also indicate that many organizations still use field tests independently to collect information about the effectiveness of different products or practices. This is despite there being information related to effectiveness that may be (more) readily accessible to upstream organizations, and which could be transmitted by those organizations to downstream organizations. But, while testing explicitly provides information about effectiveness, it implicitly mitigates risk of introducing a new product or practice to the farmers, the downstream organizations, and the government. Our data did not reveal the degree to which different

criteria – such as effectiveness and cost – are considered in the decision making process because of their effect on farmers and/or different organizations own priorities for farmers. Given these findings we recommend:

- Donors and others with convening power continue to invest in conveying information useful for the identification stage of the decision making process through stakeholder meetings and conferences, e.g., the various input-output platforms being tested across Eastern Africa.
- Donors and others with convening power convey information related to product or practice performance to INGOs and local NGOs, which may expedite the evaluation and selection stages of the decision making process by allowing local NGOs to deploy – with more information and thus less risk – new products and practices at greater scales, quicker instead of conducting their own timely and costly field tests. Organizations may even consider developing arrangements that incentivize deploying products and practices at greater scales, quicker. However, this assumes that donors and others with convening power do in fact have (better) information and are aware that they have it.

These recommendations have conditions under which they can be practically and responsibly implemented.

First, we realize that upstream organizations that may have the ability to shape which products or practices are used in programming (Warren and Frongillo (2017)) may not always have the chance to interact with the mid-level decision makers in downstream organizations. We do not know if information shared with a downstream organization is conveyed to the actual decision maker responsible for programming choices. Certainly, mid-level decision makers must be exposed to performance information for our second recommendation to be practical.

Second, we realize that the risk of introducing a new product or practice – even with better information flows about performance – may still appear to a downstream organization as unevenly shared between upstream organizations and that organization. After all, it is the downstream organization that has relationships with farmers, which they wish to preserve. They know best how a poorly performing product or practice will impact a farmer's livelihood. We note that upstream organizations could develop mechanisms to share that risk with downstream organizations, and make local performance testing simply a complement to performance information relayed from an upstream organization. For instance, upstream organizations could reward downstream organizations for taking a risk such as quickly and widely deploying a new product or practice after limited performance testing, or even agree to compensate farmers if a new product or practice underperforms – though the secondary effects of this would need to be thoroughly considered. A derivative of this is that as downstream organizations increasingly and successfully rely on upstream organizations for performance information, trust may grow between them. Alternatively, we note that a third party organization that is well regarded by upstream and downstream organizations could broker performance information, to minimize the perceived risk. This raises the question,

however, of who would fund the collection and dissemination of performance data. (As we noted above, performance testing also garners buy-in from farmers and government, so may not be replaced but perhaps achieving scale may be done quicker.)

An alternative lens on the issue of risk is related to which organizations hold power in the program. Our results show that downstream organizations consider a product or practice when an upstream organization, via a work plan or stakeholder meeting, asks them to (though our data do not consider the cases where downstream organizations do not consider it). It may be due to inherent promise for the option or because the downstream organization feels like they cannot decline to do so. There is limited potential harm in an upstream organization getting involved in the identification process – in the worst case, a downstream organization tests and eliminates something that performs poorly during the evaluation and selection processes, respectively. But there is potential harm in an upstream organization getting involved in the evaluation and selection processes, if power dynamics lead a downstream organization to quickly scale a product based on weak information from an upstream organization. Certainly, mid-level decision makers must be exposed to strong performance information for our second recommendation to be responsible.

Areas for Future Research

These results suggest several areas for future research. First, it appears relevant to quantify (e.g., using surveys to generate additive scales, see DeVellis (2003)) how risk, power, and information are spread across programs like YieldWise.

Second, the idea of the menu emerged multiple times and deserves further treatment. Specifically, it could be insightful to identify the products or practices that do not appear on the menu because they were never identified, or were eliminated during evaluation or selection. This may require different methods; semi-structured interviews that rely on recall (e.g., why did you not include that product) may offer more bias than ethnographic (i.e., embedding in the decision making process) or experimental methods (i.e., sharing some information at some times with some organizations but not others, and measuring its effects).

Third, a greater understanding of the decision making process and the information available at each of the three stages, as defined in this report, could strengthen when and what upstream organizations share with downstream organizations. This understanding could be improved by repeating this work with more organizations, with more individuals in the same organizations, or with longer interviews or time spent with more organizations and/or individuals.

Fourth, an unstudied, but highly relevant dimensions of the decision making process is the timeframe and individual characteristics of the decision makers, such as how much interaction they have with donors and other upstream organizations. The question of timeframe is intertwined with our result and recommendation about piloting (which typically requires one growing season), and the question of the decision makers' characteristics is intertwined with

our results and recommendation related to conveying identification and technical performance data.

Finally, it may be appropriate to develop a typology of decision making processes, and attempt to evaluate where and when GKI's toolset affects different decision making processes.

Conclusions

We use qualitative data from eleven interviews with stakeholders from organizations in Tanzania to examine the decision making process behind selecting products or practices for programs related to the Tanzanian post-harvest sector. We find that information necessary to identify products for use in programs – types, cost, availability – flows from organizations with convening power or those convened to organizations that have a more direct role in programming, but that many organizations still play a role in directly collecting information on performance with field tests. These tests serve multiple purposes – engaging farmers and government, and reassuring the organization of the quality of the product. However, the provision of more information related to performance from organizations with convening power to organizations that have a more direct role in programming may serve to expedite the evaluation and selection stages of the decision making process, or at least the scaling process that comes after selection. Accordingly, we recommend that donors and others with convening power convey more and strong information related to product or practice performance to INGOs and local NGOs. However, the information must be strong and delivered to and possibly from the individuals core to the decision making process for this recommendation to be practically and responsibly implemented.

Authors and Acknowledgements

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Appendix Document 1 – Interview Guide

First, I want to get a sense of you and your organization, and where you and your office fit in within it and its post-harvest loss work.

1. What organization do you work for?
2. How long have you been at [your organization]?
3. Have you personally completed projects related to post-harvest extension and training before?
   a. Have you personally completed projects related to post-harvest storage before this?
   b. Have you personally completed projects related to video extension training before this?
4. How many people work in this office?
5. To which other office in [your organization] do you travel to the most?
6. From which other office in [your organization] do you receive staff from the most?
7. Has your organization completed projects related to post-harvest loss before?
   a. Has [your organization] completed projects related to post-harvest storage before this?
   b. Has [your organization] completed projects related to video extension training before this?
8. How many times do you communicate with staff from [your organization's] head quarters per week?
9. How many times do you communicate with people from [your organization's] field locations per week?
10. Generally, who in your office makes key decisions related to products and processes used in programs?
11. Generally, who in [your organization] makes key decisions related to products and processes used in programs?

I want to understand, generally, your role in identifying, evaluating, and selecting among options for solutions to post-harvest loss in Tanzania.

12. Do you help make decisions in [your organization's] programs related to post-harvest loss in Tanzania?

13. Can you tell me about a recent technology product or process related to post-harvest loss that your organization used in a program?
14. In you and your organization's decision making, what were the steps in deciding on the technology product or process to use in the program?
    prompt for identifying, evaluating, selecting steps
    prompt for hold separate meetings for each step, do different people help with different steps
15. How long did this process take? What step took the longest?
16. Did you consider other products [processes]?
    a. If yes: What other product [or process] options did you consider?
    b. If not: Why not?
17. How did you identify them?
    a. Was it a group effort to identify them?
        i. If so, who led the conversation?
    b. Did you need to gather information from sources (e.g., people, internet) outside of your office to identify them?
    c. What information did you gather?
    d. Were there any barriers to gathering this information?
    e. Was there information you lacked?
18. How did you compare and select them?
    a. Was it a group effort to compare them?
        i. If so, who led the conversation?
    b. What were some of the factors you used to compare them?
    c. Was it a group effort to select them?
    d. What were the factors that led you to eventually select what you did?
19. Do you feel like you made the right choice? What is one thing you did not know during their decision making process that they wish they did in retrospect?

Appendix Document 2 – Code Book

Working definitions presented in Table 2 are defined as:

- *Cost* is the cost to the farmer of the product.
- *Cost-benefit* is that the cost was considered in relation to a benefit, e.g., the cost in relation to an improved quality outcome.

- *Government approval* is that government – at the national or local level – had to approve or otherwise support the use of the product or practice, e.g., by approving a new technology or by providing additional resources for the program.
- *Quality outcomes* refers to the effect of the product or practice on crop quality.
- *Logistics of providing* are the logistics or complexity, in a logistical sense, of including that product or practice in a program, e.g., the transportation logistics of running a metal silo distribution program.
- *Added benefits* are the benefits – in addition to crop quality outcomes – that emerge from using improved products or practices, e.g., health benefits of pesticide free crops stored in hermetic bags.
- *Availability* is the availability of the product on the market, e.g., there are active suppliers and retailers accessible for the organizations and farmers.
- *Large institutions and firms* is the support – from large financial institutions, government, or private firms – for the product or practice, e.g., providing targeted loans or using extension officers to promote a practice.
- *Amount of crop* is that, on a practical level, the amount of crop to store or process is a criterion in choosing the scale of the intervention, e.g., silo and warehouse versus individual bags. We present it here independent of, for instance, cost-benefit because it actually relates to multiple criteria, e.g., large institutions and firms, who may have different financing schemes for different interventions of different target crop amounts.

Working definitions presented in Table 3 are defined as:

- Consult other organizations: getting input and feedback from peer organizations working in the same field or from the upstream organization
- Use internal or external experts: consulting individuals who can provide specific insight about a certain technology or a key area of the market
- Operationalize donor work plan: deploying products and programs based on the work plan generated from or with or the proposal to the upstream donor organization
- Attend conference: getting information about products and practices from formal conferences and informal meetings between various stakeholders
- Review journals: gathering information about a certain product from published papers and/or grey literature
- Consult other offices of the same organization: getting input and feedback from other offices, usually in a different country, of the same umbrella international organization
- Test in field: testing the performance of the technology with actual crops in the local environment of the end-users for a prescribed amount of time
- Work with farmers: engaging farmers in the testing process and/or providing training to farmers on how to use the technology
- Test in lab: testing the performance of the technology in a controlled environment that is not necessarily reflective of the end-user's local environment

- Desk research: looking for information from online databases
- Develop consensus among partners: gathering and incorporating feedback from all the upstream organizations and local implementers involved in the projects
- Present "menu": providing farmers with a list of product or practice options and sometimes relevant information to help them make an informed choice
- Engage government (later): working with the government to obtain approval and additional support for the deployment of products or practices
- Engage supply chain actors: working with processors, argo-dealers, potential buyers, and account for their input during one or many stages of the identification-evaluation-selection process

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End Notes

[i] Generally, direct support organizations are those that pay or subsidize firms or organizations to sell products or practices to farmers. One organization works with the local manufacturers and provides farmers with better crates for the transportation of tomatoes. One organization assigns project managers to work with individual farmers to conduct field tests and train people on how to use hermetic bags. One organization set up demonstration plots in various areas to train farmers how to use various technologies. One organization sends engineers to the field to train local artisans to build metal silos.

[ii] Generally, we grouped these organizations because they broker interactions between the farmers, the product or practice retailers, and sometimes the crop buyers. One organization's main operation is identifying ways to add value to the farmer's crop, then connecting the farmers to the processor and potential buyers. One organization provides farmers with samples to test the technologies at home, then aggregates demands and connect them to local argo-dealers who carry the products. One organization works more heavily with argo-dealers, connecting them to manufacturers for a better price and introducing them to farmers. One organization focuses on connecting local NGOs to private sector commercial farmers and helping them find a partnership model that is mutually beneficial.