TOOL BOX
FOR WORKING WITH ROOT, TUBER AND BANANA SEED SYSTEMS

RTB User Guide

Multi-stakeholder framework

User Guide to the Multi-Stakeholder Framework for Intervening in Root, Tuber and Banana Seed Systems

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This user guide is intended to disseminate research and practices about production and utilization of roots, tubers and bananas and to encourage debate and exchange of ideas. The views expressed in the papers are those of the author(s) and do not necessarily reflect the official position of RTB, CGIAR or the publishing institution.

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Acronyms

CIP	Centro Internacional de la Papa (International Potato Center)
CRS	Catholic Relief Services
DVM	Decentralized vine multiplier
FAO	Food and Agriculture Organization of the United Nations
FG	Farmer group
NGO	Nongovernmental organization
QDS	Quality declared seed
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SSSA	Seed system security assessment

Abstract

Root, tuber, and banana crops are important for food security and commerce, especially in the tropics. They are vegetatively reproduced, unlike crops grown from true seed. Vegetative seed faces unique challenges: it is bulky, perishable, and susceptible to pests (especially diseases), while root, tuber and banana seed systems have suffered from low investments.

This user's guide presents a tool, called the 'multi-stakeholder framework for intervening in root, tuber and banana seed systems.' It is designed to help any interested person to understand seed systems of these crops or to improve interventions (e.g., projects or programs) in them. The framework may be graphed as a table, with rows of stakeholders (e.g., policymakers, researchers, and seed producers) and columns of characteristics: availability of seed, access, and quality. Access includes delivery channels, affordability, and awareness. Seed quality includes crop variety and other issues (health, genetic purity, physiological age, and physical quality). Gender should always be taken into account when using the framework.

The framework can be used to plan a future intervention or to analyze an ongoing or completed one. When used before an intervention, the framework may guide a study of the existing seed system and identify bottlenecks and key actions for the upcoming intervention. When used to monitor an ongoing intervention, the framework can help to plan the evolution of activities, scope, theory of change (including assumptions about farmers and seed), objectives, and impacts. The framework will help stakeholders to think about seed systems of root, tuber and banana crops in a holistic way and to account for differences, even contradictions, in the perspectives of some of the people and organizations who are stakeholders in these crops.

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This Users' Guide is a companion to the research paper *Understanding root, tuber, and banana seed systems and coordination breakdown: A multi-stakeholder framework* (Bentley et al. 2018) and the book *Case Studies of Root, Tuber and Banana Seed Systems* (Andrade-Piedra et al. 2016). Authors of the case studies analyzed with the framework include (in alphabetical order): Elly Ouma Atieno, Jorge L. Andrade-Piedra, Danny Coyne, Paul Demo, Beloved Dzomeku, Enoch Kikulwe, Peter Kromann, P. Lava Kumar, Jan Low, Margaret McEwan, Fabián Montesdeoca, Netsayi Mudege, Jean Ndirigwe, Jean Claude Nshimiyimana, O. Odu, Kwame Ogero, Richardson Okechukwu, Ricardo Orrego, Bernardo Ospina, Ngabo Pamba, Elmar Schulte-Geldermann, Kirimi Sindi, and Valentine Uwase.

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User Guide to the Multi-Stakeholder Framework for Intervening in Root, Tuber and Banana Seed Systems

INTRODUCTION

This user guide is an updated version of an RTB working paper (RTB 2016). This new version has been specially edited to more fully incorporate gender. Root, tuber and banana crops include cassava, potato, sweetpotato, yams and bananas. All of these crops were domesticated in the tropics, where they continue to be important food security crops, produced by about 200 million farmers. In many developing countries, roots, tubers and bananas are often grown, processed and eaten by women and smallholder farmers, but their needs are usually ignored in research and interventions (Mudege et al. 2015; Fischer and Qaim 2012). This may thwart the functioning and sustainability of seed systems.

Because root, tuber and banana crops are planted from vegetative seed (roots, tubers, vines, stems, and suckers), their seed systems are unlike those of grain and pulse crops, which have dominated the research and development agenda. Vegetative seed has the advantage of allowing the crop to multiply true-to-type, because the planting materials are clones, genetically identical to the parent plant. On the other hand, RTB seed is more susceptible to carrying pests (including viruses and other pathogens, according to the FAO's 1996 definition), which makes vegetative seed more challenging to manage than true seed. Vegetative seed is also highly perishable and root, tuber and banana crops require many more kilograms of seed per hectare than do grains or pulses. For all these reasons, vegetative seed is more likely to be produced and distributed locally than grain or legume seed.

Vegetatively propagated crop (VPC) seed systems have suffered from low investments, loosely organized value chains and poorly documented evidence of the value of interventions. However, in recent years major donors are investing heavily in root, tuber and banana seed systems, to disseminate new varieties and to reduce the yield gap in existing ones.

The objective of this user's guide is to present a tool, the 'multi-stakeholder framework for intervening in root, tuber and banana seed systems,' to help practitioners, donors and policy makers to improve interventions in such seed systems, especially on the design and analysis of the interventions. The framework is a simple tool to grasp the complexity of vegetative seed systems, and consider the perspectives of different stakeholders, to be able to improve the availability, access and quality of VPC seed. The framework should be used in combination with existing tools (e.g., literature reviews, participatory rural appraisal, market studies, etc.) and those described in the toolbox for working with root, tuber and banana seed systems (Andrade-Piedra et al. 2020).

THE FRAMEWORK

This tool is a slightly modified version of the *multi-stakeholder framework for intervening in root, tuber and banana seed systems* (Sperling et al. 2013, Table 1). This framework is a table; the first column lists the stakeholders (people, roles or organizations) of the seed system. The characteristics of the seed system (availability, access and quality) are listed across the first row.

Table 1. Multi-stakeholder framework for intervening in root, tuber and banana seed systems (Sperling et al. 2013).

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Variety (incl. biodiversity)	Health, genetic purity, physiological age, & physical quality[1]
Policy makers						
National research						
International research						
Traders (local markets)						
Specialized seed producers						
Farmer organizations						
NGOs & national extension						
Private food sector						
Seed users						

[1] From Thomas-Sharma et al. (2015)

The multi-stakeholder framework is an adaptation of the seed system security assessment (SSSA), developed by Remington and colleagues (2002) around three concepts derived from food security: access, availability, and utilization (quality). Distinguishing access from availability helped to identify if an emergency required seed to be imported (availability problem) or sourced locally (access problem). This simple dichotomy helped CRS (Catholic Relief Services) and partners move away from doing emergency seed work with imported seed to addressing access with vouchers. CRS and partners put these ideas into practice many times during emergencies. Sperling (2008) later coined the term SSSA and applied it to a wider range of development contexts, not just for emergencies.

Between December 2012 and September 2015, the SSSA framework was adapted for the CGIAR Research Program on Roots, Tubers and Bananas (RTB). During five workshops, experts from RTB, NGOs, and Wageningen University revised the multi-stake holder framework and chose case studies to test and refine it under different conditions, maximizing diversity (various crops, in Latin America and Africa, from small to multi-national projects). The authors of the case studies were insiders, with much experience working in the region and with that particular crop. These case studies have been compiled as a book (Andrade-Piedra et al. 2016). The multi-stakeholder framework for intervening in root, tuber and banana seed systems is referred to as 'the framework' from here on.

DEFINITIONS OF CONCEPTS IN THE FRAMEWORK

SEED SYSTEM

A **seed system** is the network of stakeholders involved in producing and planting the seed (including vegetative seed) of a particular crop in a certain area. The seed system is associated with certain agricultural and seed-production technologies, and with the genetic resources needed to produce the seed. Seed systems can be formal or informal, depending on the extent of regulation and integration with the public and commercial seed sector. Formal seed sector regulation varies by crop and context, but by definition includes some form of an inspection process known as 'certification' and controls over crop varieties, to ensure that the seed is healthy and of a recognized variety. Informal seed systems are less regulated. They are also huge, diverse, and poorly documented.

STAKEHOLDERS

This section defines various groups of stakeholders (actors, roles and organizations involved in a given activity). The **stakeholders** in a seed system or intervention may include:

- **Policy makers**, who set national policy for seed, including seed quarantine, seed certification, research and extension. Local officials, e.g. at the district level, may also be included.
- **Donors**, including private foundations, multilateral (e.g. UN agencies) and bilateral (e.g. USAID) which fund projects for agricultural research and development. National governments, especially in middle income countries, also fund important seed system interventions. This group of stakeholders has not previously been considered in the framework, but should be.
- **Agricultural researchers**, includes scientists at national and international centers. Plant breeders develop new crop varieties, but other researchers are important for creating new pest and disease management techniques (e.g. for seed-borne pests and diseases), and for seed management (e.g. storage, planting densities). Social scientists like anthropologists, economists, and gender specialists help to describe the goals and perspectives of different stakeholders in the seed system and address particular questions (such as why varieties are being adopted or rejected). Some research agencies also multiply seed, and curate the breeder seed, used to produce certified seed. Research should cooperate with extension to learn farmers' demands and to offer solutions to seed growers and seed users.
- **Traders** buy and sell seed. They often deal in informal seed, but they can also sell formal, certified seed. They may be found in local markets. They often have other activities besides dealing in seed, for example they may buy and sell ware produce as well.
- **The private seed sector** includes companies dedicated to producing or selling seed, often as part of the formal sector.
- **Farmer organizations and specialized seed producers**. The key word is 'specialized'. These are not simply farmers who sell some of their ware production as seed. They use some technique to produce a crop designated as seed, and they are usually organized into groups. Some seed producers are highly organized and others are *ad hoc* creations of a project. Women often participate in these groups and some groups are made up only of women.
- **Extension** (NGOs and government agencies) teach the seed users and the specialized seed producers to manage the seed. Extensionists do most of the work on the projects led by international research, mainly because NGOs and extension agencies have the personnel to do the work: to train farmers, strengthen their groups, multiply seed in the field, distribute planting material and conduct awareness campaigns.

- **Private food sector processors** include food manufacturers, supermarkets, even restaurants and others who buy ware produce, add value to it, and sell it. Some processors also distribute seed, but this group is more important as a stimulus, buying farmers' commodities, demanding certain varieties, setting quality standards (e.g. potatoes of just the right size and composition for making chips) and requiring a stable supply of produce.
- **Seed users** are the most important stakeholders. They are the farmers who buy or trade for the seed, who accept or reject the new crop varieties, and who still manage the bulk of crop seed on their own farms. Many of the seed users are women, whose livelihoods can be enhanced through proper seed interventions.

This list of stakeholders is suggestive, and can be added to. As you design your own framework for your own seed system, you may want to split some stakeholder categories in two or add new types of stakeholders.

SEED SYSTEM CHARACTERISTICS

The characteristics of a seed system are here defined as availability of seed, access to seed and seed quality.

Availability (of seed). Seed supply. The physical existence of the seed. Having enough seed at the right place and time.

Access (to seed). Farmers have money or other resources to obtain and use seed. Access is divided into three sub-categories: delivery channel, affordability and awareness.

> **Delivery channel**. The transport, location, distribution and logistics of getting seed from point A to point B.
>
> **Affordability**. The farmers can buy the seed at the going price. The seed is profitable to use. Affordability can be influenced by markets; as farmers earn more money from a crop they can afford to pay more for seed. An intervention can make seed more affordable through subsidies, including vouchers (where farmers receive a piece of paper which they can exchange for seed).
>
> **Awareness**. Information about how and where to get quality seed and how to use it, including price information.

Seed quality includes the concepts of 1) desirable varieties and 2) quality in the strict sense: health, genetic purity, physiological age and physical quality.

> **Desirable crop varieties**, especially those that respond to market or farmer demand. 'Desirable varieties' is often linked to modern varieties, improved for higher yields or better nutrition, but farmers may also demand local varieties. Biodiversity (in a seed system) includes the genetic diversity of local varieties (sometimes also called land races, biotypes or ecotypes) of crops. Each crop has a wealth of genetic diversity, which is often threatened (by replacement with modern varieties).
>
> **Quality (health, genetic purity, physiological age, and physical quality)**
>
> - Quality seed is healthy. Pests (including emerging ones) have been managed.
> - Genetic purity: Seed has no mixtures of other varieties.

- The seed is of good physiological quality, for example it is not dried out, and it is of the right age (e.g. seed potatoes should be aged until they are green and sprouted, and yam seed has a dormancy period, but most other vegetative seed is best planted fresh).
- The seed is of good physical quality, e.g. the right shape and size for planting. Free of mechanical damage.

Cross-cutting themes include seed regulations and policies, sustainability, and gender:

Seed regulations and policies include standards that can enable farmers and seed producers to improve seed quality. There is a need to understand how seed regulations can be best used to manage declining seed health over successive generations (degeneration) (Mudege and Walsh 2016). Policies and regulations can be formal or informal, such as informal norms that regulate conservation, use and exchange of seed.

Sustainability is important because few seed system interventions survive after the project ends. It also includes environmental sustainability, particularly because many root, tuber and banana crops depend on wetlands and irrigation to produce seed. Seed systems must not only be institutionally and environmentally sustainable, they must also ensure that both men and women benefit and neither is harmed (Mudege and Walsh 2016).

Gender (e.g. of seed producers and seed users) should be considered when analyzing seed availability, access and quality. For example, women smallholders may be less able to afford seed, and so have unique problems with access. The framework broadens the understanding of gender and equity to include knowledge that men and women have, how they participate in ensuring quality seed, in decision-making, how they benefit from seed systems and marketing, and their influence on policy. Social norms, especially gender norms, can keep goals from being achieved and can prevent men and women from benefiting (Mudege and Torres, 2017).

USING THE FRAMEWORK

The framework can be used to plan an intervention, and to analyze its results. So far, the framework has been used mostly after the project has ended, to analyze results of an intervention (see the book of case studies, Andrade-Piedra et al. 2016; see also CONPAPA and Marando Bora examples, below).

Before starting an intervention, the framework can help to organize one's thoughts by doing a **context analysis** to understand the socio-economic conditions on which the seed system is operating: a literature review of the crop and the geographical area of the intervention (see Figure 1). Topics should include:

- Key stakeholders
- Type of farming systems
- Market importance of the crop
- General seed sector characteristics
- Trends, developments, on-going change of context
- The socio-economic context including gender.

Place special emphasis on interventions previously conducted with this crop, in your project area. A review of publications and grey literature is fast and easy and allows you to ask better questions of

the people you will interview later. If needed, complement with field visits using existing tools, e.g. PRA (participatory rural appraisal) through key informant interviews, field visits. It may be interesting to interview women apart from men, to appreciate their unique perspectives (Bentley 2016).

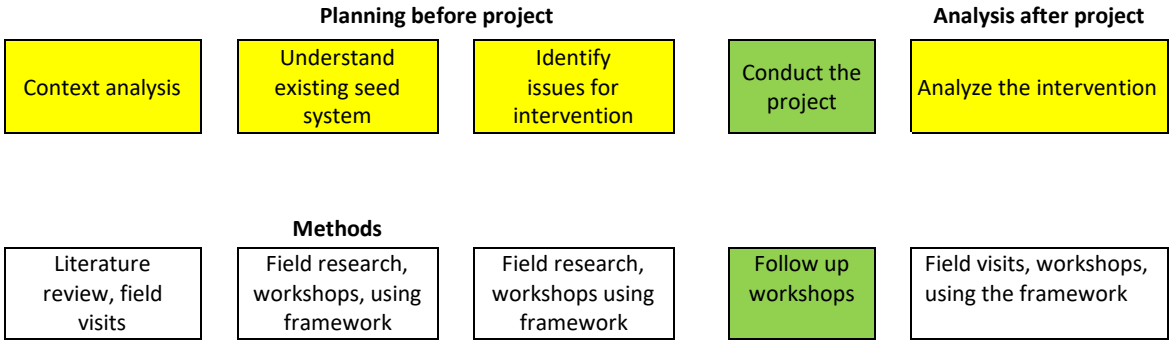

Figure 1. Using the framework for project planning, implementation and analysis (each method, in a white box, corresponds with the stage in the project cycle, in the yellow box above it).

USING THE FRAMEWORK BEFORE THE INTERVENTION

The framework can be used to help design the intervention, by understanding the existing seed system and identifying key bottlenecks. The use of the framework to plan an intervention has yet to be validated.

USE THE FRAMEWORK TO UNDERSTAND THE EXISTING SEED SYSTEM

Once you have defined your stakeholders (from the context analysis), place them in the first column (as in Table 2) and place the characteristics of the seed system across the first row. Fill in each cell with one or more questions: what role does that stakeholder play in that characteristic? What do you need to know about the stakeholder's role in order to design a seed intervention? Examples of the types of questions to ask are listed in Table 2. You may also craft your own questions to ask about the system.

To answer the questions required we will need different tools from social sciences (interviews, market studies, gender analysis, etc.) and from biological sciences (experiments to assess the effect of seed quality, surveys to estimate incidence or severity of a pest, etc.). The timeframe for answering these questions varies from few weeks, to a couple of years or more.

In cases where information is critical, but lengthy research is impossible, the study team can make educated guesses with key informants or assumptions can be rendered as explicit as possible. In these cases, the framework is actually helping to define research agendas by pointing out the topics that need to be addressed to answer a research question or test a hypothesis.

Hold key informant interviews with people who represent the different stakeholders. During the interviews, ask them to discuss the questions that you have previously identified in your own version of Table 2. For example, ask the policy makers to explain seed certification policy. Ask the

researchers how they identify demands for new varieties, and so on. Each interview will consist of several questions. There are various published guides on how to do a semi-structured interview (e.g. McCracken et al. 1988, Bentley and Baker 2002, chapter 4).

Certain questions can be asked in multi-stakeholder workshops. Stakeholders may disagree, so facilitation should be carefully done. For some basic ideas on how to facilitate a workshop, see Hogan (2002) and Seeds of Change (2011). See also Ogero et al. (2015) for the results of an evaluation workshop using the framework.

Table 2. Questions to ask when doing a diagnosis according to the multi-stakeholder framework for intervening in root, tuber and banana seed systems.

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Variety (incl. biodiversity)	Health, genetic purity, physiological age, and physical quality
Policy makers	What policies restrict seed availability? What are the quarantine restrictions on availability? Are regulatory agencies producing seed (in unfair competition with the private sector)? Do policies affect seed availability for men & women?	Are seed producers licensed? If so, how? What are the import-export regulations? What opportunities & constraints do seed delivery channels offer men & women?	Which subsidies & tax policies influence seed? Do policies make seed accessible to men & women?	What training is done on certification? How is certified seed promoted? Does information target both men & women?	Do regulations promote the use of native varieties? Which regulations oversee the international trade of vegetative seed? What are the regulations on germplasm imports?	What are the quarantine issues? How does quarantine work? Is there internal quarantine of infected areas? What is the seed inspection & monitoring? Pest & disease surveillance? Are there government labs for pest diagnosis?
International & national research, incl. breeders	Do researchers have enough foundation & basic seed? How do researchers identify the needs of male & female seed users?	What is their source of genetic material? What are the barriers to obtaining source seed? How do researchers disseminate new varieties? Do they also produce seed for sale (incl. under-the-table sales)? Is this one reason they promote certified seed? How do delivery channels reproduce gender biases?	How do they make basic seed affordable to seed producers? Does research sell seed or give it away?	How & what do they know about men & women farmer demand for varieties & quality? How do they promote new varieties? Is dissemination designed to appeal to men & women? Who knows what varieties & seed are available? How does research know which varieties have been abandoned?	Is there a gene bank? Do researchers have access to it? Do they know what the local varieties are? Are there issues of conservation of varieties? What steps need to be taken to preserve them? How do gender roles inform the adoption or rejection of varieties & different types of seeds?	What are the health problems? Quarantine issues? What mechanisms are available to ensure that farmers have quality seed (e.g. certification, clean seed, tolerance level of pests)? How do gender roles influence access to quality seed?
Traders (local markets)	When do they sell seed (seasons)? Do they have enough quality planting material with farmer preferred traits to sell?	Where & how do they get & sell their seed? Are they able to participate competitively in the seed market? Are they full-time specialized seed traders? If not, what else do they do?	What price do the traders pay for seed? How do they decide how much to sell?	How do they distinguish seed from ware? How do they estimate demand? Do they know their suppliers & customers? Do women traders have equal access to market information?	What varieties do they sell? How do they know which variety is which? Do traders know if men & women prefer different varieties?	How do they select, store & condition seed? How do they know if the seed is healthy?

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Variety (incl. biodiversity)	Health, genetic purity, physiological age, and physical quality
Private seed sector	What companies sell vegetative seed? What volume is sold & when?	What is the source of their seed? Are they full-time seed specialists or do they do other activities?	What are the pricing issues? How are prices set?	How do companies advertise & create awareness? How do they reach men & women?	What crops & varieties do they sell? Do they understand the needs of men, women & other groups?	Same as above
Farmer organizations & specialized seed producers	Do they have enough source seed? Are other inputs available (e.g. nets for making tunnels for sweetpotato tunnels)? Are women & disadvantaged groups active in these groups?	Where do they get source seed? Do farmer groups made up of women have special constraints in the delivery channel?	What is the price of the seed they sell? What techniques do they use to make seed affordable? Do farmer groups respond to gender related constraints?	Do they know where to get different kinds of seed? How do they promote or advertise seed? How does promotion target men & women?	What varieties do they produce? How do they know which varieties are in demand by men & women? What do they know about local varieties? Can they distinguish varieties to avoid mixing?	How do you control quality? How do they store seed? What pest & disease diagnostics do they do? Do groups train women members, youth & other disadvantaged groups on seed quality?
NGOs & national extension	Do they have enough seed to deliver? How much seed do they need? How do they ensure that women & disadvantaged groups have access to seed?	Do they deliver seed? Do they facilitate the connection between users & source? How many farmers do they reach? How do they reach women & disadvantaged groups?	How do they set the price? Do they subsidize seed? Do they use seed vouchers? Do they give seed away? Do they target women with training at the same rate as men?	Do they promote varieties? Or other specific kinds of seed e.g. clean seed? What do they teach farmers about seed use (which enables access)? Do they involve both men & women?	What drives the selection of varieties? Do women & disadvantaged groups demand different varieties? How do they learn about that demand? Do they promote on-farm seed management to men & women?	How do they train farmers about seed health? Do women & disadvantaged groups have access to training & quality seed? What does extension do to ensure equitable access? Is extension aware of the pests & diseases in seed?
Private sector processors	When do they need ware product & how much? Do they also need a supply of seed? Do they produce seed?	Do they distribute seed to farmers?	If they sell seed, what pricing mechanism do they use? Cash sales? Credit? Subsidies? How do they price it?	What characteristics do farmers want? How do they promote desired varieties with farmers?	What are the manufacturing qualities they demand (e.g. sugar in potatoes)? What varieties do they need?	What are their standards? How do they do quality control?
Seed users	Do they have enough seed at the right time? Do women & disadvantaged groups have access to enough seed?	Where & how do they get seed? Where & how do women & disadvantaged groups get seed? What constraints do they face accessing seed?	How much does the seed cost? Do farmers have money? What is the price of different types of seed (e.g. tissue culture, certified)? How much are men & women seed users willing to pay? Is seed affordable to women & the poorest?	Do they know where to get each type of seed? Do farmers share info about new varieties? How widely? Do men & women know about seed quality, how to manage &access quality seed?	What varieties do they grow? For market? For the household? Mono-crops? Mixes? What is the cultural significance of the varieties? Local efforts to conserve varieties? What varieties are favored by women & disadvantaged groups? Is each type of seed easily available? What local norms regulate use & exchange by men & women?	What are the main pest & diseases from the perspective of men & women? Perceived reduction in yield? Seed health standards? Do women & disadvantaged groups have special issues or problems with seed health?

USE THE FRAMEWORK TO IDENTIFY ISSUES FOR INTERVENTIONS

After using the questions in Table 2 to learn about the existing seed system, the framework can be used to identify bottlenecks and define key actions for the seed system intervention. Bear in mind the stakeholders in the intervention, and the roles that each will play (Table 3).

Many interventions will be based on a few critical assumptions, because conducting full studies is usually beyond the scope of development projects. In those cases, consider collecting information to test the assumptions while the project is implemented to provide feedback and redirect the intervention in repeated cycles of action and research.

Table 3. Potential roles and actions in an intervention, based on the multi-stakeholder framework for intervening in root, tuber and seed systems.

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Quality, variety (incl. biodiversity)	Health, genetic purity, physiological age, & physical quality
Policy makers	Beneficial policies can increase seed supply	Allow or inhibit change in the system	QDS can lower seed costs	Implicitly or tacitly allow projects to share info	Set standards. Promote varieties	Set & adapt standards, e.g. QDS
National research	Breed & release varieties. Provide source seed	Can link other stakeholders, register seed producers. Provide in vitro seed		Participate in projects that gather & share info	Plant breeding	Can produce healthy seed & provide seed health surveillance Can influence policy change using scientific evidence
International research	Provide source seed. Develop new seed techs. Lead projects. Train govt. research & ext.	Projects organize farmer groups, and provide seed	New technologies can lower costs. Projects subsidize seed	Multi-stakeholder platforms, field days, demos, training extension, t-shirts, caps, posters, radio, manuals	Breed & promote varieties, including disease-resistant ones	Collaborate with national research to develop new techs & gather evidence to influence seed system design
Traders (local markets)	Distribute seed to farmers (usually ignored by projects)	Build their channels based on trust & on their networks	Projects may distort markets when distributing free seed	Can disseminate information about new seed varieties	Handle all varieties	Often made the scapegoat for quality problems
Private seed sector	Tissue culture labs provide *in vitro* plantlets	Can produce seed for farmer groups. Invest in new technology	Multiply seed. To adopt tech from research	Use gender responsive methods to share info about new seed		Rear clean seed. Receive training in seed management
Specialized seed producers & farmer organizations (include women)	Organize seed production. Farmers can be organized with help from other stakeholders. Learn new techs	Buy, sell, & multiply seed. Receive training in seed delivery. Host project activities. Train men & women members	Lower seed prices via QDS. Sell to farmers at affordable prices. Reject impractical techs	Promote their seed & varieties. Receive training	Demand varieties	Create practical quality control. Manage new seed techs. Share info w/ research. Influence policy makers. help evaluate seed
NGOs & national extension	Train & organize farmers	Buy & distribute seed, e.g. to organized farmers. Train farmers to multiply & dist. Seed	Help to research & teach new technologies. Buying seed may help support farmer groups	Share info between stakeholders. Conduct awareness campaigns. Train farmers	Promote varieties	Produce quality seed. Can provide quality control. Train farmers to manage pests in seed crops
Private sector processors	Can provide seed	Can distribute seed to farmers	Buy food, stimulate farm earnings	Stimulate demand for supply of food	Demand varieties	Demand quality standards

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Quality, variety (incl. biodiversity)	Health, genetic purity, physiological age, & physical quality
Seed users (in some crops most are women)	They produce much of their own seed. Buying from seed producers stimulates the whole system.	Adopt & adapt new seed tech. Are often neighbors of organized farmers or seed producers	Give seed to neighbors. Do they have access to seed? New or certified seed can be profitable for some & not others	Often want to sell commodities, which stimulates demand for seed	Demand varieties with preferred traits	Demand quality. Plant disease may spread through informal networks

USING THE FRAMEWORK TO MONITOR ONGOING INTERVENTIONS AND ANALYZE COMPLETED INTERVENTIONS

As a seed system intervention progresses, bottlenecks will be solved and perhaps new ones encountered. The framework can help to visualize and document this evolution of the seed system. After the intervention, the framework will help to identify critical issues for future seed system interventions. The same questions of Table 2 can be asked to stakeholders that participated in the intervention.

In addition to the questions generated by the framework, you may include:

- Brief description of the activities, components, scale and scope
- Theory of change: what assumptions were made on the farmer demand of seed, the seed quality of local seed vs project seed
- Information on scaling up, achieved objectives, impact (monitoring and evaluation component).

The framework was tested by analyzing 13 completed interventions (Andrade-Piedra et al. 2016; Bentley et al. 2018). Two of those case studies are summarized below.

Example 1: CONPAPA (potatoes in Ecuador)

CONPAPA is a farmers' organization in Ecuador, established to connect smallholders to their buyers and to consumers in the cities. Researchers helped the organized farmers create links with buyers. Those new links, and an expanding market for potatoes to supply the cities, allowed farmers to sell better potatoes at higher prices. Improved sales meant that farmers could now afford seed, but not certified seed, which was often in short supply anyway. Smallholders in CONPAPA organized themselves to buy high quality source seed potato from Ecuador's National Agricultural Research Institute (INIAP), plant it and produce their own quality declared seed (QDS), which they sold to seed users.

Organized seed producers receive training and collaborate in quality control visits. CONPAPA does quality control with the farmers (not like a visit from the police), finding problems, and counselling farmers on how to improve quality in the future. CONPAPA's experience with seed has influenced the Ministry of Agriculture in Ecuador to change the quality control guidelines used for certified seed, and to include parameters developed by the intervention for a seed category equivalent to quality declared seed as part of the legal seed system (Table 4).

Table 4. Roles and results of the CONPAPA case, potato in Ecuador.

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Quality, variety (incl. biodiversity)	Health, genetic purity, physiological age, & physical quality
Policy makers	Women and indigenous farmers were able to access quality planting material		Allowed farmer to produce QDS			Used quality criteria from CONPAPA to set new seed standards
National research	Develops & releases varieties Provides certified seed	An earlier project forged links between farmers & other stakeholders		Training material was adapted for women and training was conducted in local language		
International research				Supported multi-stakeholder platforms	Facilitated policy change for QDS	
Farmer organization (CONPAPA)	Set production plans of QDS	Bought certified seed. Organized sales of QDS to farmers	QDS lowered price of seed	Promoted commercial varieties. Promoted women leadership in CONPAPA	Provided quality control	Made standards more realistic. Influenced the Ministry of Agriculture to change the quality control guidelines
NGOs		Bought seed from CONPAPA		Helped share info between actors		
Private sector processors				Stimulated demand for constant supply	Stimulated demand for varieties	Demanded quality (e.g. size, health)
Seed users			Women, indigenous farmers could afford QDS seed		Demanded the varieties offered	Demanded high quality seed

Example 2: Marando Bora (sweetpotatoes in Tanzania)

Marando Bora (better vine) was a project designed to share healthy sweetpotato planting material with 150,000 farmers in Tanzania. Initially the project conducted a gender analysis of the seed system to help shape the project strategy. Women in Tanzania are the major producers of sweetpotato, but the selection criteria for vine multipliers excluded women who were not literate or did not have access to land. Although some literate, landed farmers (mostly men) were trained to produce sweetpotato vines as individuals, the project then set a target for women's participation as decentralized vine multipliers (DVMs), deliberately encouraging women and men to form vine multiplication groups so that women could access land as a group. They provided women with a way of overcoming the scarcity of land and other resources. These vine growers would sell their planting material to other farmers, who would pay with subsidized vouchers. The vine growers produced several improved varieties, which they reproduced from virus-free material, although there were problems with re-infection in the field. Various NGOs provided training and facilitated farmer groups, although this took more time than was anticipated and some of the NGOs could not keep up with all of their groups. In the second year of the project, more vines were produced *en masse* at central points. Some vines were given to farmers for free at schools, reducing the

transaction costs of the voucher system. The project sensitized farmers to buy the vines. Virus-free seed can improve yields, if farmers buy enough vines to plant a whole field (Table 5).

Table 5. Roles and results of the Marando Bora case, sweetpotatoes in Tanzania.

Stakeholder	Availability/ supply	Accessibility			Quality	
		Delivery channel features	Affordability/ profitability issues	Info to create awareness & demand	Quality, variety (incl. biodiversity)	Health, genetic purity, physiological age, & physical quality
Policy makers	Project attended district council meetings			Explained importance of intervention local leaders	Developed QDS guidelines. Clean seed became available for men & women farmers	
National research		Kenya was source of clean seed		Targeted men & women with training (in groups as well as individual DVMs)		Produced in vitro seed
International research	CIP led the project, to make seed available to farmers at low cost	Project organized farmer groups & vine growers, mostly near farmers	Project subsidized the cost of the seed	Shared info with posters, radio etc. Conducted a gender analysis & incorporated results in design of intervention to ensure benefits to men & women farmers	Provided & promoted new varieties	Re-infection by virus a constant problem
Private seed sector		Some private growers produced seed				Reared clean seed
Farmer organizations	Project organized farmer groups which included women					Used net tunnels
NGOs	CRS & local NGOs were project sub-grantees	Organized farmer groups & distributed seed		Conducted awareness campaigns targeting men & women		Trained male & female seed growers to manage pests & diseases
Seed users		Users often lived in same village as seed producers	Vines were low-cost, or free	Project targeted women to use the seed		

CONCLUSION

We propose the multi-stakeholder framework as a practical tool for use during planning, monitoring and implementation of RTB seed system interventions. The framework is useful for thinking in a more integrated and holistic way: taking into account different stakeholders and key characteristics (especially access, availability, and quality) and recognizing that stakeholders often have unique perspectives and agendas for these characteristics, which can be even in conflict with the perspectives of others. Also, the perspectives of different stakeholders are not always recognized

from the start of project design. Some interventions ignore the perspectives of some stakeholders on certain issues while giving credence to the perspectives of others on the same issue. Unfortunately, this is not unique to root, tuber and banana seed interventions.

This simple framework for analyzing RTB seed systems and interventions can be used across different crops. It will be a useful to have such a standard analytic framework, to assess, design, plan and evaluate seed system interventions. The framework promotes a common vocabulary for seed practitioners to communicate, draw distinctions, make comparisons, assess similarities, even across the different countries and cultures that care for, and are in turn fed by banana, cassava, potato, sweet potato, yam and other root and tuber crops.

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