Staff Paper

Effectiveness of the bean seed dissemination models implemented under the Bean Technology Dissemination (BTD) Project: Results of key informant interviews in Guatemala, Honduras and Nicaragua

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Byron Reyes, David DeYoung and Mywish K. Maredia,

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Department of Agricultural, Food and Resource Economics
MICHIGAN STATE UNIVERSITY
East Lansing, Michigan 48824

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Department of Agricultural, Food and Resource Economics
Michigan State University

[1] Corresponding author: reyespad@msu.edu

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Executive Summary

Farmer access to improved variety seeds of staple crops has always been one of the perennial challenges of agricultural development. The USAID-funded Legume Innovation Lab implemented the 'Bean Technology Dissemination' (BTD) project in 2010 in four countries in Central America and the Caribbean: Guatemala, Haiti, Honduras and Nicaragua, using different seed production and dissemination models. The BTD project aimed to increase agricultural productivity, profitability and income of rural smallholder farmers by introducing proven technologies like improved bean varieties. It was expected that this increased productivity would also address nutritional and food security concerns by the national governments as well as potentially reduce malnutrition and contribute to long-term sustainability and vitality of agriculture systems. This research report presents the results of key informant interviews carried out in Guatemala and Honduras in 2013 and two community seed banks (CSBs) surveys carried out in Nicaragua in 2012. The purpose of this report is to provide an analysis of the unique features of different models for seed multiplication and distribution implemented under the BTD project so as to identify principles of sustainability present/absent from these different models and derive implications and lessons for broader applicability to other countries where Innovation Lab research programs are active.

In Guatemala and Honduras, key informants from organizations/entities along the seed value chain that have collaborated in the BTD project were interviewed in person (and in one case by phone), following methods to elicit expert opinions and using semi-structured questionnaires. The project partners were grouped into five types of informants (one survey instrument was developed for each type) and a sample was drawn for interview from each type. These informants were sampled based on the degree of collaboration in the project (i.e., priority was given to the most active collaborators) and representatives from most organizations were included. A total of 25 interviews were carried out in Guatemala and 36 interviews were done in Honduras.

In contrast, for Nicaragua two survey instruments were developed to collect data on the CSBs established in the first two years of the BTD project. INTA extension workers or the CSB promoter administered these surveys. In addition, a visit to all five regional offices was done during the second year of the project to explain these instruments and request assistance of extension workers and CSB promoters in collecting the data. About 200 CSBs were included in the survey, but only 153 responses were obtained for the first survey (about the CSB's characteristics) and 149 responses were obtained for the second survey (about seed production costs).

The results indicated that seed production was under the responsibility of different partners, depending on the type of seed. While production of Foundation and Registered seed was under the responsibility of governmental agencies and Zamorano (in Honduras), production of quality-declared seed was under the responsibility of many partners, including government agencies, CIALs, farmer groups, NGOs, CSBs, etc. Further, while most of the quality-declared seed was produced using Registered seed, the partners collaborating with Zamorano used Foundation seed to produce quality-declared seed.

The distribution of quality-declared seed was done in all three countries thru a network of collaborators that included NGOs, CSBs, CIALs and governmental offices, among others. Further, while the seed distribution models were similar across years within Honduras and Nicaragua, the model was different for 2012 than 2011 and 2013 in Guatemala due to political reasons.

The background of the project's collaborators interviewed in Guatemala and Honduras was diverse and in these countries, having non-contractual arrangements with partners/collaborators was more common than having contractual arrangements. In Nicaragua, there were no contracts with the partners (CSBs) producing and distributing the quality-declared seed.

To make this project a reality, implementing partners in Guatemala and Honduras established alliances with partners, identified beneficiary communities and beneficiary farmers within these communities and coordinated training for partners' staff and seed producers. Further, producing enough basic and foundation seed (needed to produce the quality-declared seed) for all partners in Honduras and other countries was necessary.

Farmers were offered seed of several improved varieties. Although the number of varieties distributed in all three countries increased over time, the amount of seed distributed per farmer decreased. Further, while farmers in Guatemala and Nicaragua where only given conventionally-bred varieties, in Honduras, farmers were given both conventionally-bred and participatory-bred varieties.

The BTD project was designed with the aim of making production and distribution of quality-declared seed sustainable over time. Thus, to reduce farmers' dependency on receiving or expecting free seed from the project, beneficiary farmers were told they needed to pay back the seed they received and this amount varied by country. In general, the "price" of the quality-declared seed (determined by the amount of grain farmers needed to return compared to the amount of seed received) in all three countries was the same or twice the price of grain. Except for Guatemala, given that in Honduras and Nicaragua the price of the seed distributed thru the project was similar to the price of certified seed, it is likely that other factors (e.g., physical accessibility and timely availability) may explain why farmers do not purchase certified seed. However, additional work on this topic is necessary.

While most beneficiary farmers (receiving quality-declared seed) agreed to the payment agreements, repayment rates were variable. In Guatemala, key informants reported that roughly only one out of every three farmers paid back the agreed amount of grain for the seed they received in 2012. In contrast, in Honduras, between 57% and 71% of beneficiary farmers receiving conventionally-bred varieties and 82% of beneficiary farmers receiving participatory-bred varieties have paid back the agreed amount of grain for the seed they received. In both Guatemala and Honduras, the agreed amount varied. However, in Nicaragua, 53% of beneficiary farmers repaid twice the amount of seed they were given. This repayment rate excludes farmers who may have paid different amounts (e.g., pound by pound), which occurred in some regions as per the beneficiary survey, but such data were not reported in the survey of the CSB. This variability in payment rates is understandable since enforcing the payment agreement is difficult. As one might expect, low payment rates could threaten the sustainability of these models.

In general, farmers in all three countries were satisfied with the quality of the seed they received and with the varieties received (though some farmers wanted different varieties). However, although many informants in Guatemala and Honduras reported that the amount of seed distributed per farmer in 2012 was adequate (though some informants in Honduras reported that farmers wanted more seed), in Nicaragua, CSBs could not satisfy the demand for seed, suggesting that farmers wanted more seed. Further, while most seed was distributed on time for planting, there were some small issues with late seed deliveries across all three countries.

Across countries, there were many strengths and weaknesses of the models implemented by the BTD project to distribute seed to beneficiary farmers. Some of the common strengths across countries were the high quality of the seed that was produced and distributed and the installed capacities of partners. Some common weaknesses included the limited training of partners, limited technical assistance to farmers and in a few cases, late seed deliveries. Although the latter was true, most farmers in all countries received the seed on time.

Further, to make these models more efficient in the future, key informants in Guatemala and Honduras reported there are constraints in both the supply (e.g., additional resources, producing more seed/varieties) and demand (e.g., finding new markets) sides of the seed value chain that should be taken into

consideration for future similar initiatives. Also, in all countries it is clear that partnering with other institutions or strengthening alliances with partners is necessary to become more efficient and reach as many farmers as possible.

Thus, for this type of projects to be successful, these results suggest that selecting the right partners along the supply chain and good coordination is key. It is extremely important to identify good seed producers and to constantly supervise them to guarantee the quality of the seed. Also, producing and distributing enough bean varieties adapted to the regions of interest is key. It is also necessary to have a clear idea of the amount of quality-declared seed that will be distributed to farmers since this has implications for the breeding programs that will be supplying the foundation/registered seed that will be needed to produce this seed. Careful planning and coordination of seed production, packaging and delivery to partners is fundamental to have the seed ready for distribution when and where it is needed.

While the production of quality-declared seed can be done in different ways, the ideal partner to assist in the distribution of seed must have installed capacity in the regions where the seed is to be distributed. It should also have good collaboration with farmers, good logistics, experienced staff, and resources available so that this process could be easily incorporated as a marginal (or add-on) activity to the portfolio of activities already carried out by this partner. Further, a good/solid relationship among partners is key for the success of this and any other technology dissemination project.

It is important to educate farmers about the differences between sowing grain vs. seed and to help them differentiate the varieties they are given. For the latter, it is important to supply the seed in a sealed package with a label containing all relevant information (like the name of the variety). Also, for individuals/groups producing and distributing seed within a community, additional training on seed production techniques and marketing practices might be necessary.

As one might expect, late seed deliveries should be minimized. However, given the limited amount of time between when the seed is harvested and when it needs to be distributed, delivering the seed late for planting in some (especially distant) regions may be a fact. Since late seed deliveries were more common in models without local (i.e., within the community) seed production, finding ways to produce the seed more close to where beneficiary farmers will receive it should help to avoid late seed deliveries (though there are cost implications of this that should also be considered).

Finally, if this and similar projects are to be sustainable, it is important to supply quality-declared seed at an affordable price (which was possible under the BTD project) and to determine the best way to recover the cost of producing the quality-declared seed, especially among local seed producers/distributers that have no secured market. This is easier said than done since it is challenging to enforce payment arrangements unless the quality-declared seed is sold in cash at the time of delivery. If beneficiary farmers do not pay back the seed they receive in credit, it will be difficult for the individuals or groups supplying seed to have enough capital to continue producing seed over time. The results suggest that models that include local partners within the community to produce and distribute the seed might have a better chance to recover these investments.

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Key to Abbreviations

BTD	Bean Technology Dissemination Project
CRSP	Collaborative Research Support Program
CSB	Community Seed Banks (or *Bancos Comunitarios de Semilla*)
FAO	Food and Agriculture Organization
M&E	Monitoring and Evaluation
MSU	Michigan State University
mz	Manzana (1 manzana = 7,000 square meters)
NGO	Non-Governmental Organization
qq	Quintal (100 lb-sack), or Cwt. (hundred-weight)
USAID	United States Agency for International Development
Guatemala	
COCODES	*Comités Comunitarios de Desarrollo*
FONTIERRAS	*Fondo de Tierras*
FUNDIT	*Fundación para la Innovación Tecnológica, Agropecuaria y Forestal*
ICTA	*Instituto de Ciencia y Tecnología Agrícola*, Institute of Agricultural Science and Technology
MAGA	*Ministerio de Agricultura, Ganadería y Alimentación*
MIDES	*Ministerio de Desarrollo Social*
SNEA	*Sistema Nacional de Extensión Agrícola*
SOSEP	*Secretaría de Obras Sociales de la Esposa del Presidente*
Honduras	
ACCESO	USAID-funded project implemented by NGO FINTRAC in Western Honduras
ADICH	*Asociación para el Desarrollo Integral de Campesinos de Honduras*
ANACH	*Asociación Nacional de Campesinos de Honduras*
ASOPRANOO	*Asociación de Productores Agrícolas del Norte de Olancho*
ATRIDES	*Asociación Trinacional para el Desarrollo del Trifinio*
CARE	An International Humanitarian Organization
CEDA	*Centro de Entrenamiento de Desarrollo Agrícola*
CENOC	*Centro de Negocios de Ocotepeque*
CIALs	Local Agricultural Research Committees
COMPROIL	*Cooperativa Mixta de Productores Integrados Lta.* (a cooperative of rural banks)
CONEANFO	*Comisión Nacional de Educación Alternativa No Formal en Honduras*
CORESER	*Consejo Regional del Sector Reformado*
CRS	Catholic Relief Service
DIACONIA NACIONAL	Social arm of the Christian Reformed Church of Honduras
DICTA	*Dirección de Ciencia y Tecnología Agropecuaria*, Institute of Agriculture and Livestock Science and Technology
EAC	*Empresa Asociativa Campesina*
EAP	*Escuela Agrícola Panamericana, Zamorano*
ECAS	*Escuela de Campo Agrícolas*, Farmer Field Schools
ETEA	Development and Cooperation Foundation
FIPAH	*Fundación de Investigación Participativa con Agricultores en Honduras*
FUNDER	*Fundación para el Desarrollo Empresarial Rural*
IHCAFE	*Instituto Hondureño del Café*
INA	*Instituto Nacional Agrario*
OCDIH	*Organismo Cristiano de Desarrollo Integral de Honduras*
PIF	*Programa de Investigación de Frijol (Zamorano)*
PILARH	Non-Profit Association, name given after one of its founders

PROSADE	Promoting Food Security in Choluteca and Rio Negro Watersheds, a CARE project
PRR	*Programa de Reconstrucción Rural*
PUCA	Community-based organization of the *Refugio de Vida Silvestre Montaña de Puca*
SAG	*Secretaría de Agricultura y Ganadería*
UNA	*Universidad Nacional de Agricultura, Olancho*
UNAH	*Universidad Nacional Autónoma de Honduras*
UNEDESOLA	Second degree rural bank
UNERMA	Second degree rural bank
UNIOSEN	Second degree rural bank
Nicaragua	
INTA	*Instituto Nicaragüense de Tecnología Agropecuaria,* Nicaraguan Institute of Agriculture and Livestock Technology
UNISEM	*Unidad de Semillas,* INTA Nicaragua

Effectiveness of the bean seed dissemination models implemented under the Bean Technology Dissemination (BTD) Project: Results of key informant interviews in Guatemala, Honduras and Nicaragua

1. Introduction

Farmer access to improved variety seeds of staple crops has always been one of the perennial challenges of agricultural development. Many models of seed multiplication and distribution system have been tried and are based on a combination of private, NGO and public sector partners playing niche roles in filling the gap between technology supply and demand. Examples of some of the models used to fill this gap include systems based on farmer cooperatives, strengthening networks of village-based agro-dealers, promoting farmer operated seed enterprises, supporting farmer associations or local agricultural research committees (CIALs), etc. The Legume Innovation Lab (formerly known as the Dry Grain Pulses CRSP) under its 'Bean Technology Dissemination' (BTD) project has used some of these models. This project, currently in its final stage, was implemented in four countries in Central America and the Caribbean: Guatemala, Haiti, Honduras and Nicaragua. Among these models, the model being used in Nicaragua is the most novel and unique, which is based on the concept of community managed and operated seed banks or "*bancos comunitarios de semilla.*" (CSBs). The seed bank model operates on the principles of self-help, whereby community members come together to produce seeds to meet their own current needs, save seeds for future seed security, and sell excess seeds to generate revenues to cover production costs. In Honduras, the model being used is based on a private university (Zamorano), CIALs (or farmer associations), seed producers (i.e., farmers, micro-enterprises, and local seed banks), government, and NGOs taking up the role of seed multiplication and distribution. In Guatemala, the model is based on the public and NGO sector playing a major role throughout the seed value chain. Finally, in Haiti, after trying different approaches, producing and distributing the seeds to resource poor farmers has been more effectively done through alliances with NGOs.

The BTD project offered a good opportunity to do an in-depth analysis of: 1) the unique features of different models for seed multiplication and distribution so as to identify principles of sustainability present/absent from these different models and derive implications and lessons for broader applicability to other countries where Innovation Lab research programs are active; and 2) to assess the benefits derived from these dissemination efforts from the perspective of beneficiary farmers who received the seed from the project. The BTD project integrated a monitoring and evaluation (M&E) component to conduct research focusing on these two research questions. This report represents one of the outputs of the M&E activity focused on the first research question.

Although the BTD project was implemented in four countries, the analysis in this report was carried out only for Guatemala, Honduras and Nicaragua. Haiti was not part of this study due to the many challenges faced by project partners, which limited seed dissemination activities in the country at the time of the surveys. Further, while the analysis for Guatemala and Honduras corresponds to the second year of the project, since this was the latest completed year of activities at the time when the interviews were carried out (mid-2013), for Nicaragua, the results correspond to the first year of the project since this is when data collection was conducted. The next section provides background information about the BTD project. Section 3 details the methodology and describes the key informants interviewed. Section 4 provides an overview of the bean supply channels prior to the project. Section 5 discusses the results of the analysis. Finally, section 6 includes lessons learned.

2. Background information: BTD project

Maredia, Reyes and DeYoung (2014) include detailed information about the BTD project and its major achievements over its lifetime. Thus, we provide a brief description and achievements of the BTD project next. The BTD project was implemented in several of the poorest, most food insecure countries in the region. Malnutrition is widespread in these countries, especially among the vulnerable populations. Although these countries heavily depend on agriculture, productivity of staple crops (such as beans and maize) is generally low due to climate change, natural disasters, and, among other factors, the limited use of purchased inputs by smallholder farmers and limited access to new technologies.

The rapid bean technology dissemination project implemented by the Dry Grain Pulses CRSP in 2010 was in response to the goals of the Feed the Future (FTF) program being implemented by the USAID missions in the region. Particularly, the BTD project focused on increasing productivity of beans by poor smallholder farmers in these countries by making accessible and available quality-seeds of improved bean varieties. It was expected that this increased productivity would address nutritional and food security concerns by the national governments as well as potentially reduce malnutrition and contribute to long-term sustainability and vitality of agriculture systems (Maredia, Reyes and DeYoung, 2014).

The objectives of the BTD project implemented from 2010-2013 were to increase agricultural productivity, profitability and income of rural smallholder farmers by introducing proven technologies, one of these being improved bean varieties. The BTD project implemented different models for seed production and distribution in each country; some were complex and involved many partners while others were relatively simple. Even within the same country, the models evolved over time. In all countries, careful planning and logistical coordination were needed to make the project work. Next we describe the main partners in each of the countries where the BTD project was implemented. The main institution supplying most of the genetic and foundation seed (used to produce the seed that is distributed to farmers) to all collaborators in the region during the first year and most years was Zamorano, a private agricultural university located in Honduras. During the first year of the project, Zamorano, along with the Institute of Agriculture and Livestock Science and Technology (DICTA) were responsible for implementing and coordinating all project activities in Honduras. In Nicaragua, the main implementing partner was the Nicaraguan Institute of Agriculture and Livestock Technology (INTA) and in Guatemala, the partners were the Institute of Agricultural Science and Technology (ICTA) and the *Sistema Nacional de Extensión Agrícola* (SNEA), both subcontracted by the *Fundación para la Innovación Tecnológica, Agropecuaria y Forestal* (FUNDIT). In Haiti, the main implementing partners were the National Seed Service, the International Institute of Cooperation on Agriculture, and Agrotechnique, a private firm (BTD, 2011). While in Honduras and Nicaragua the main implementing partners have remained the same over time, in Guatemala and Haiti this has not been the case[2] (BTD, 2012).

As BTD (2014) final report shows, the BTD project distributed 543 metric tones (MT) of bean seed and reached 102,047 beneficiary farmers over the lifetime of the project across the four countries. As they detail, year 3 is when most seed was distributed and most farmers were benefited. The country with the highest number of beneficiary farmers over the three years of the project was Guatemala. Next we describe the study methodology and present the results of the analysis.

[2] In Guatemala, SNEA did not collaborate in the project in 2012 due to government-related problems. In Haiti, Agrotechnique, in charge of seed distribution, only collaborated in the project in 2011 and ever since, other partners have assisted with the distribution of seed (BTD, 2011, 2012).

3. Methods and Key Informants

To evaluate the effectiveness of different models of bean seed dissemination used in Guatemala, Honduras and Nicaragua by the BTD project, and assess the constraints, challenges, and factors contributing to the success (or failure) of the different models, two of the authors visited Guatemala (July 10-20, 2013) and one author visited Honduras (August 14-30, 2013) to conduct personal interviews with representatives of organizations/entities along the seed value chain that have collaborated in the BTD project. These interviews were conducted following methods to elicit expert opinions and using semi-structured questionnaires. All interviews were scheduled prior to the country visit, with the assistance of staff from the local partners (ICTA, DICTA and Zamorano).

For Guatemala and Honduras, the partners who have collaborated in the BTD project were grouped into five types of informants and a sample was drawn for interview from each type: project coordinators, sub-coordinators, seed producers, technicians and extension workers, and CIALs and farmer groups producing and distributing seed (only in Honduras). One survey instrument was developed for each type of informant.[3] The project coordinators included leaders of the main partner institutions (i.e., ICTA, DICTA, Zamorano). Sub-coordinators included officers of the different types of ("secondary") institutions assisting the main institutions (e.g., DICTA/ICTA regional offices, FONTIERRAS in Guatemala, leaders of NGOs assisting CIALs in Honduras). For most of the analysis, the responses of coordinators and sub-coordinators were analyzed together as one "type" of respondent, since they complemented each other and the survey instruments were very similar.

Seed producers included individual producers and members of groups producing seed (one interview per group). Technicians and extension workers included people directly distributing seed to farmers. Further, in Honduras, CIAL and farmer groups producing and distributing seed included members of CIALs, rural banks, CSB, etc. The sample is representative of the largest partners in terms of their role within the seed value chain and the volume of seed they distributed. Table 3.1 includes the types of informants and numbers of interviews carried out in Guatemala and Honduras. While 61 interviews were carried out in these two countries, a total of 114 people were interviewed. This is because in several interviews, more than one person participated (however, in these cases, one group interview was conducted, not individual interviews). As the table shows, more interviews were carried out in Honduras than in Guatemala.

In contrast, for Nicaragua two survey instruments were developed to collect data on the CSBs established in the first two years (i.e., 2011 and 2012) of the BTD project. INTA extension workers or the CSB promoter administered these surveys, and the CSBs were asked to send the completed surveys to project coordinators. To implement these surveys, one of the authors visited all five regional offices during the second year of the project (February 4-10, 2012) to explain the data collection method and request the assistance of extension workers and promoters in collecting the data from the CSBs. In addition, during these visits, INTA staff from each regional office presented the outcomes, challenges and lessons learned from the first year of the BTD project, which are reflected in this report.

The first survey instrument was a structured survey of the CSB's formation, membership, training, administration and seed production in year 1 (i.e., 2011) of the BTD project. The second survey instrument was an activity journal of seed production costs that captured inputs and labor used to produce seed for the BTD project in the second year (i.e., 2012) of the project. All the CSBs from the five regions (i.e., Pacífico Norte, Pacífico Sur, Las Segovias, Centro Norte and Centro Sur) where the project was implemented were included in the sample. The latter instrument was provided to the CSBs prior to the season when they were going to produce the bean seed for the project so they could record actual

[3] Survey instruments can be made available (in Spanish since these were developed in Spanish) upon request from the corresponding author.

information about production costs as opposed to providing recall data from the previous seed production season. A total of 153 responses were obtained for the first survey and 149 responses for the second survey (Table 3.1). While the final version of the CSB survey was submitted by four of the regions, the Centro Sur region submitted answers to questions from a draft version of the CSB survey that was used during the training. The differences between the draft and final versions of the survey and data that were not captured for the Centro Sur region as a result of completing an incorrect version of the questionnaire are noted with "n.a." in the corresponding tables since the information is "not available."

Table 3.1. Number of key informant interviews, surveys and people interviewed in Guatemala and Honduras (July-August, 2013) and Nicaragua (February 2012), Bean Technology Dissemination (BTD) Project.

	Country			
Key informant/survey type	**Guatemala**	**Honduras**	**Nicaragua****	**Total per type**
Coordinators	1	2	--	3
Sub-coordinators	7	8	--	15
Seed producers	2	7	--	9
Technicians/ Extension workers	15	11	--	26
CIALS and other farmer groups producing and distributing seed	--	8	--	8
Survey of CSBs	--	--	153	153
Record Keeping of CSBs' Production Cost	--	--	149	149
Total interviews	25	36	302	**363**
Total people interviewed*	27	87	302	**416**

* In some interviews, more than one person participated.

** Number of respondents assumed to be 1 per CSB per survey. Information about 1,087 CSB members, however, is included in the CSB member characteristics.

-- = Not collected since this type of informant/survey does not exist for this country.

4. Overview of the bean seed supply channels in BTD countries prior to the project

In all three countries, the seed supply chain is evolving. One common characteristic across the three countries (and many other countries where beans are grown) is that most small and medium-sized farmers re-use the grain they harvest, as seed in each season. If farmers were able to preserve the quality of the seed, then this practice would be fine since the genetic quality of bean seed should not decrease over time (or would slowly decrease). However, poor management of the crop and poor post-harvest management can greatly decrease the quality of the seed, which may drive yields down. Farmers with poor crop/post-harvest management would require new (high quality) seed more often than farmers who know how to produce and preserve bean seed.

Another common characteristic across countries is that there are government programs in place to provide free or subsidized seed to farmers. Further, purchasing certified seed is rare due to its high price, and the private sector's involvement in bean seed production for direct sale to farmers has been negligible (some private organizations are providing seed for the government's seed program). The BTD project was implemented to provide an alternative model of making low-cost, high-quality bean seed available to farmers locally, in a sustainable way. The following sub-sections depict how bean-breeding programs made seed of improved varieties (IVs) available to farmers prior to the BTD project.

4.a. Guatemala

As Table A4.1 shows, the main channel ICTA's bean-breeding program has used to make seed of IVs available to farmers is thru the government seed distribution program. This government program demands foundation seed from ICTA to produce Certified seed and has been implemented by the Ministry of Agriculture, Livestock and Food (MAGA), which then distributes the seed free of charge to farmers (this is an ongoing program). The main strength of distributing seed thru the government program is that farmers are exposed to new IVs generated by the research program, which they would not be able to have access to otherwise. However, there are several weaknesses of this channel. These include: a) in some cases the seed was distributed based on political interests; b) ICTA became a seed producer for MAGA (as opposed to fulfilling its mandate of conducting research); c) the production of certified seed was contracted to a few large farmers/firms which could be unsustainable because it relied in only one buyer (i.e., the government program); d) farmers started expecting free seed every year; and e) there was no technical assistance provided along with the seed that was distributed.

Providing technical assistance along with the seed (and other inputs distributed by this program), particularly on how to produce good quality seed could be valuable to reduce farmers' dependency on this program. Further, having clear guidelines on how the seed is to be distributed, along with increased monitoring (or even third party monitoring) might help to deter distributing seed based on political interests.

FAOSTAT (2014) production data show an upward trend in bean production in Guatemala after 2005, with a decrease in production in 2008 (Figure A4.1a), possibly due to the food crisis of 2007/2008. The observed increase in production has been due to an increase in the bean area harvested, which drastically increased after 2005. However, since the government program was started in 2004, it may be possible that this upward trend in production and area harvested may be a direct outcome of this program, but no analysis has been done to assess this causal link. Further, CNP (2014) wholesale price data suggest that average bean prices drastically increased in 2008 and have remained high ever since, showing a slight downward trend after 2012 (Figure A4.1b), which suggests that the government program may be contributing to stabilizing prices (though at a much higher price than prior to 2008) in the country.

4.b. Honduras

In Honduras, the seed channels used by the breeding programs to make seed of IVs available to farmers prior to the BTD project varied depending on the type of IV in question (Table A4.1). The main distribution channel for IVs developed by conventional breeding has been the ongoing government program (called *Bono Tecnológico Productivo*, currently the *Bono Solidario).* Among the main strengths of making seed of IVs available to farmers thru this program are the good logistics of the program since it has been functioning for several years (it is an established program), it is an alternative for farmers to access seed of IVs that they would not access otherwise, farmers receive varieties with higher genetic potential, and the program has contributed to price stability since it has not allowed production to decrease.

FAOSTAT (2014) production data show that bean production in Honduras was variable between 2000-2006, remained stable between 2006-2010, and it has increased since 2010 (Figure A4.1a). The recent increase in production has not been due to an increase in the bean area harvested since this area has slightly decreased since 2010, suggesting that yields have slightly increased in recent years. The fact that the government program was started in the 2006/2007 agricultural year suggests that this program may be fulfilling its purpose since production has stabilized or increased since 2006; thus confirming that production has not decreased since the program was started. Although production has remained stable or increased in recent years, CNP (2014) wholesale price data suggest that the average annual bean prices have been extremely variable since 2000 (Figure A4.1b). Further, bean prices were surprisingly high in 2008 and 2011 (highest since 2000) and although prices decreased in 2012 and 2013, they currently seem to be increasing. These data suggest that, although the government program may have contributed to stabilize or increase bean production, it has not contributed to price stability in Honduras.

The government program implemented in Honduras has several weaknesses, including: 1) seed distribution: As in Guatemala, seed distribution is sometimes done following political interests; 2) the quality of the seed and the genetic quality of the varieties is not always guaranteed (for some varieties, the quality of the seed distributed was low, perhaps an indication of a lack of supervision of seed producers); and 3) some of the varieties have been distributed in environments not suitable for them, hence farmers are dissatisfied with the performance (i.e., production) of these varieties.

Participatory Plant Breeding (PPB) is a strong research component of the breeding program in Honduras. Thru PPB, farmers organized in local agricultural research committees (CIALs), conduct breeding research and are able to develop improved bean varieties (called PPB IVs from now on). For this type of IVs, the main seed supply channels have been the CIALs and seed funds. The main strengths of these channels are that seed distribution cost is low for the NGOs assisting the CIALs since the latter groups are responsible for distributing the seed and that CIAL members receive training on how to produce and preserve the quality of the bean seed. The main weakness of distributing seed thru these channels is that this is not a permanent source of seed for farmers because seed is not always readily available.

In both Honduras and Guatemala, political interests are a major weakness of the government programs. Further, in Honduras, the issue with the low quality of the seed that is distributed suggests that increased supervision along the seed supply chain (i.e., from seed producers to processing plant) might be needed. Finally, the bean IVs should be distributed taking into consideration the environments for which they were developed, since farmers who grow an IV that is not adapted to his/her environment might obtain low production, which will discourage him/her from growing IVs again.

4.c. Nicaragua

In Nicaragua, government programs such as the *Programa Nacional Libra por Libra* (PNLL) implemented beginning in 2002 and the *Programa Alimentario de Semillas* (PAS) beginning from the

2007-08 agricultural year represent national programs like those in Honduras and Guatemala that supply bean seed of improved varieties to farmers. Non-government organizations and programs sponsored by the international donor community have implemented similar programs on a smaller scale and have provided bean seed to farmers prior to the BTD project. As in Guatemala and Honduras, using saved grain as seed is common in Nicaragua.

In the 2008-2009 agricultural year, the Nicaraguan Ministry of Agriculture and Forestry (MAGFOR) reported that certified bean seed only covered 6.2% of total area in which beans were cultivated (MAGFOR 2009). To increase use of quality bean seed, two seed production models were proposed--1) production and promotion of certified seed: An estimated 70% of total demand for seed was to be met by producing certified seed through farmer unions or "*Uniones"* comprised of seed producing cooperatives. Seven farmer unions were to be strategically located across the country. As of March 2012, three farmer unions had been established. 2) Production of Apta seed: The remaining need for quality seed was to be met by Community Seed Banks (CSBs) in the form of Apta (or quality declared seed), which is the focus of this report.

FAOSTAT (2014) production data show that bean production in Nicaragua was increasing between 2000-2003, entered a volatile period between 2003-2006, returned to a stable and increasing period between 2006-2009, and has shown high annual variability since 2009 (Figure A4.1a). The variation of production has largely coincided with variation in the bean area harvested. The changes in bean area harvested from year to year could have been caused by many factors including price uncertainty among farmers when making planting decisions (thus the area planted and harvested changed) or by weather changes (which directly affect area harvested).

5. Results

This section includes the main results from the interviews for Guatemala and Honduras, and from the data collected from the CSBs in Nicaragua. First, the main collaborating partners and their role in the project are described. Then, background information about these partners is presented. Third and fourth, a discussion about the quality of the seed distributed and a depiction of the amount of seed distributed to beneficiary farmers is included, respectively. Fifth, the seed payment arrangements are reviewed. Finally, the perceived strengths, weaknesses and constraints of the seed distribution models are discussed.

5.a. Partners and their role in the BTD project

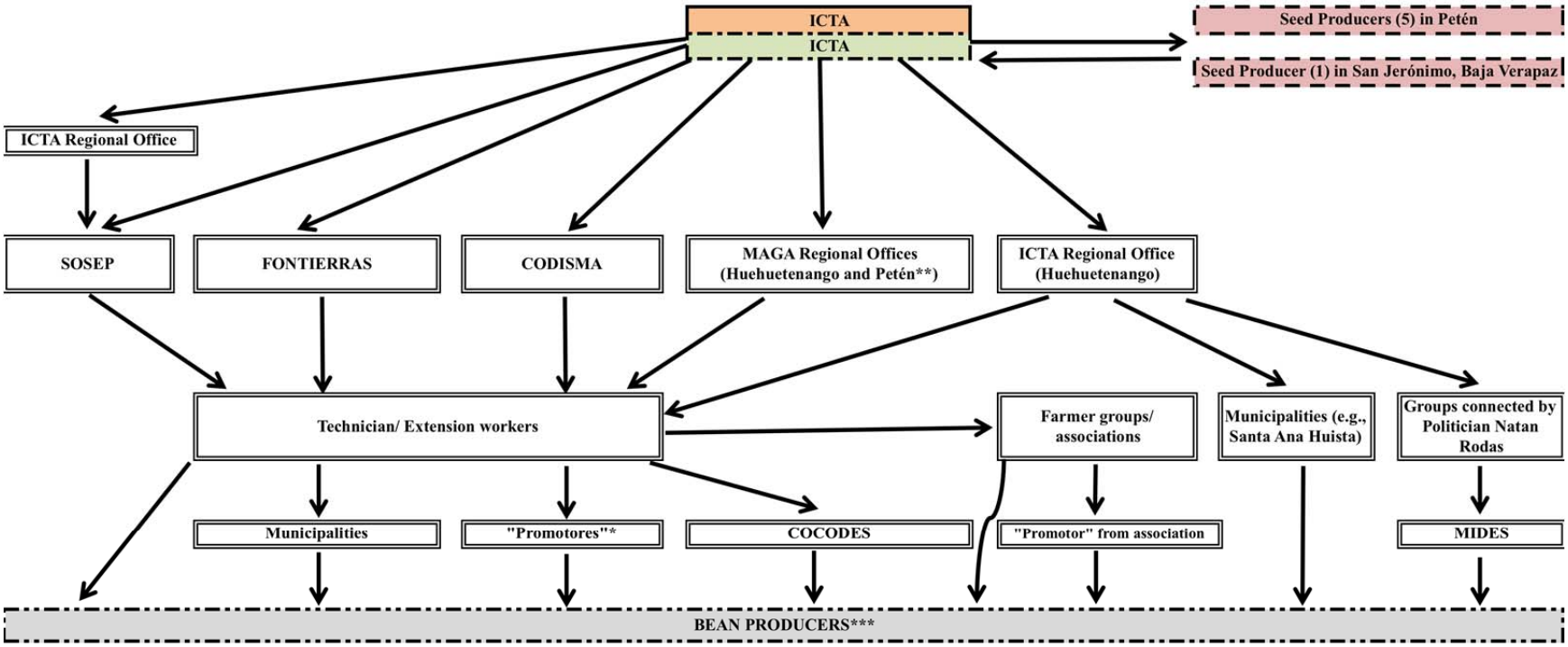
Figures 5.1-5.5 illustrate the partners who collaborated in the BTD project in Guatemala, Honduras and Nicaragua, and their role, based on whether they produced or distributed seed. These figures were developed using the information included in the annual project reports (BTD 2011, 2012) and provided by key informants during the interviews (KII, 2013). For ease of understanding, we will discuss the BTD project's partners for each country separately.

Guatemala

As Figure 5.1 illustrates, there were many partners involved in the seed value chain in Year 2 (2012) in Guatemala. ICTA was the only institution providing Foundation/Basic seed and producing Registered seed. Then, large individual seed producers used this seed to produce Quality-declared seed (with a quality equivalent to Certified seed, but without going thru the certification process). There were five seed producers in the Department of Petén and one in the Department of Baja Verapaz. ICTA's staff constantly supervised seed production to guarantee the quality of the seed (Table A5.1). Once harvested, the moisture content of the seed was reduced enough so the seed could be shipped to ICTA's headquarters for conditioning, bagging and distribution. In 2012 (Year 2), 20-lb bags were prepared for distribution in the Department of Petén and 10-lb bags were prepared for distribution elsewhere.

After conditioning, the Quality-declared seed was shipped to ICTA's and MAGA's regional offices or distributed to partners (e.g., FONTIERRAS) who then distributed the seed to farmers (thru their own extension or technical staff) or to other collaborators (e.g., municipalities, farmer groups, COCODES) for final distribution to beneficiary farmers. As Figure 5.1 illustrates, once the Quality-declared seed left ICTA's headquarters, no partner used this seed to produce more seed, which is not surprising since that was their expected role. Although we wanted to be as inclusive as possible, it is probable that some minor partners' names are not included in this figure (all major partners are, however, included).

SOSEP and FONTIERRAS used their own human and financial resources to transport and distribute the seed. Further, they drew beneficiary farmers from their own network of beneficiaries (i.e., farmers that were already assisting and who qualified to receive seed from the BTD project). Although these and all other partners had the liberty to select the beneficiaries who would receive seed, ICTA provided the criteria to identify beneficiary communities and beneficiary farmers. In general, the beneficiary communities were selected because of their high poverty rate and food insecurity problems. Communities that were already being assisted by the partners (through on-going collaboration), and/or were major bean-producing communities also received high priority. Further, beneficiary farmers were selected because they were bean producers, subsistence or infra subsistence farmers (i.e., very small poor farmers), food insecure, and/or farmers with limited resources. Thus, in general, the project was targeted to reach resource poor bean producing farmers in communities that had high rates of poverty and food insecurity.



Acronyms: *ICTA = "Instituto de Ciencia y Tecnologia Agricola"; MAGA = "Ministerio de Agricultura, Ganaderia y Alimentacion"; SOSEP = "Secretaria de Obras Sociales de la Esposa del Presidente"; FONTIERRAS = "Fondo de Tierras"; COCODES = "Comites Comunitarios de Desarrollo"; MIDES = "Ministerio de Desarrollo Social"*

* A "Promotor" is a village leader and farmer who knows village residents and have been trained either by the assisting institution or by the BTD project (excludes "Promotores" from farmer associations)

** In Peten, most seed was distributed thru the COCODES and Farmer Associations

***Bean producers also include members of the different groups or farmers who are assisted by different NGOs/Government Units

Institution	Departments where worked in 2012
SOSEP	Solola and San Marcos
FONTIERRAS	Chimaltenango, Santa Rosa, Jutiapa, Suchitepequez, Quetzaltenango, Retalhuleu, San Marcos, Huehuetenango, Alta Verapaz, Peten, Izabal

Figure 5.1 Guatemala: BTD project seed production and supply map, Year 2.

The *Comités Comunitarios de Desarrollo* (COCODES) were key partners in all regions, especially in the Department of Petén where most of the seed was distributed by MAGA thru COCODES, farmer associations or by direct distribution. Farmer associations generally distribute seed directly to their members and to some non-members. However, these associations also distribute the seed thru the "promotor" of the association, who generally fulfills the role of an extension agent and provides direct assistance to member farmers.

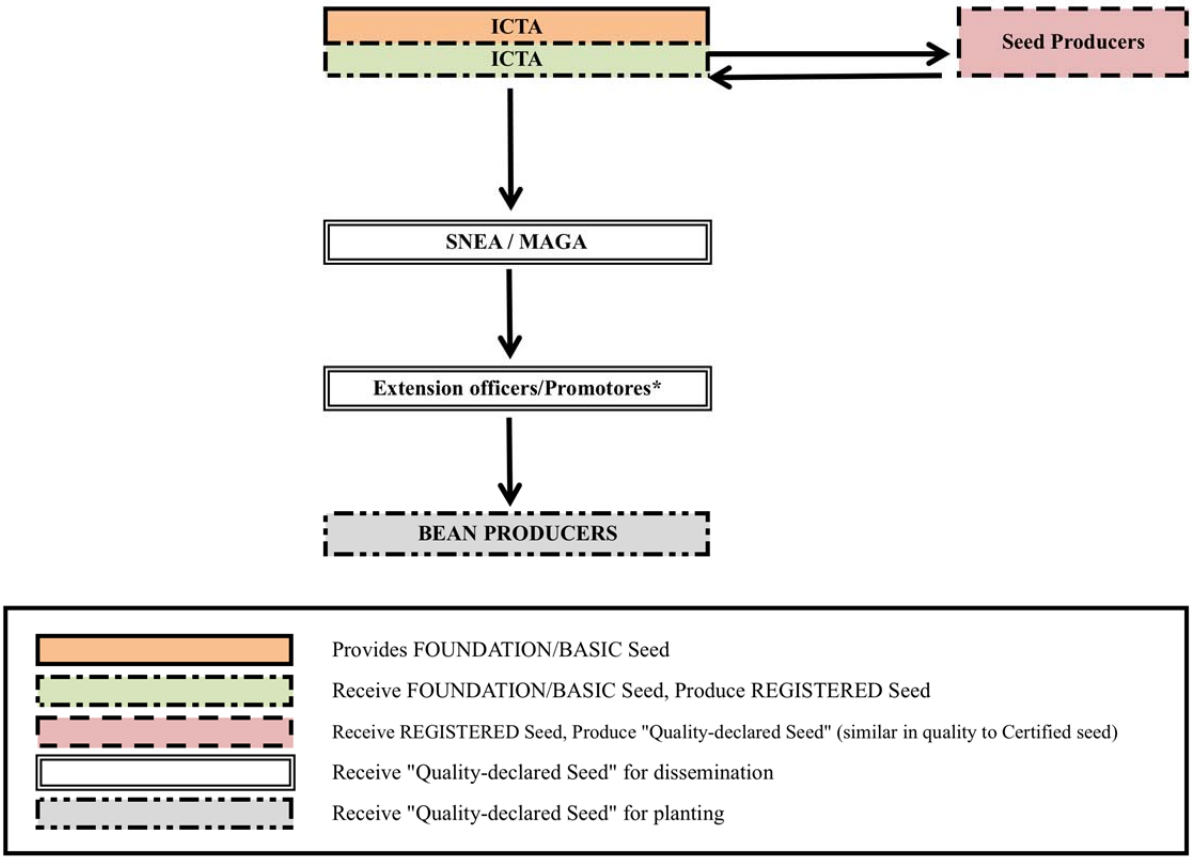
In many communities, there are "promotores" who assisted the project partners to identify beneficiary farmers and to distribute the seed. These "promotores" are different than the "promotores" of the farmer associations in that the former are village leaders and farmers who reside in the village and who have been trained by the assisting institution or the BTD project.

While Figure 5.1 illustrates the partners and their role in Year 2, this was not the case in Years 1 or 3. In Year 3, the project implementers distributed seed thru the national agricultural extension system (*Sistema Nacional de Extensión Agrícola*, SNEA). Figure 5.2 illustrates the seed supply map for Year 3 (2013). As the figure shows, the approach used in 2013 was much simpler than in 2012 since all seed was distributed thru SNEA and its extension officers or "promotores" from communities. The seed supply map for Year 1 (2011) looked the same as for Year 3 since all seed was also distributed thru SNEA. The reason why different partners collaborated in the BTD project in 2012 was that the new presidential administration took office that year and made changes at all levels, including not renewing contracts of SNEA's extension agents, which made it impossible for SNEA to collaborate with the BTD project (BTD, 2012; KII, 2013). The analysis and assessment of the seed distribution model discussed in this report thus represents the experience of a complex model that was implemented for only one year in Guatemala. Unfortunately, due to resource and time constraints, a similar assessment and data collection efforts were not carried out in Year 3 and thus we are not able to do a comparative analysis of the seed distribution model used in Year 2 vs. Years 1 and 3.

Honduras

As discussed earlier, there were two main implementing partners in Honduras: Zamorano and DICTA. Each of these institutions had their own network of partners thru which they distributed the bean seed of the BTD project in 2012. While Figure 5.3 illustrates the partners who collaborated in the BTD project in Year 2 with Zamorano and their role, based on whether they produced or distributed seed, Figure 5.4 illustrates DICTA's partners in Year 2. There were many more partners in Honduras, compared to Guatemala. Zamorano was the only institution supplying Foundation seed. Next, the partners and their role are discussed for each of these two institutions separately.

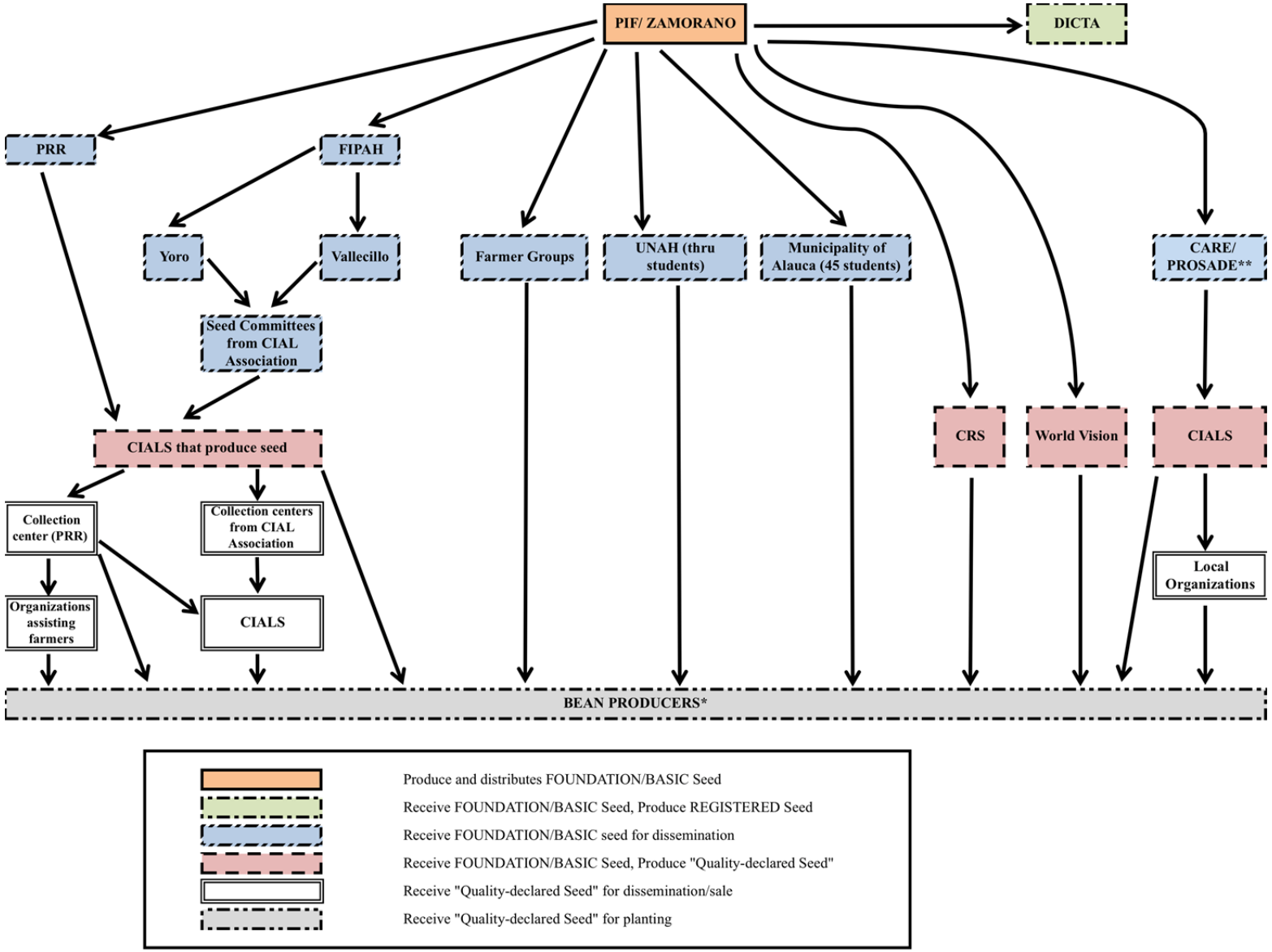
Zamorano. After the bean program of Zamorano produced the Foundation seed, it distributed this seed directly to beneficiary farmers or it shipped it to its partners who then used it to produce other types of seed (Figure 5.3). In Year 2 of the project, three of the five NGOs (i.e., FIPAH, PRR, CARE) that Zamorano partnered with used the Foundation seed to produce Quality-declared seed with local agricultural research committees (CIALs). A CIAL is a group of farmers who conduct agricultural research in their communities. Although there are many CIALs in the country (and several CIAL associations), not every CIAL has the capacity to produce seed. FIPAH, PRR and CARE produced the Quality-declared seed with CIALs that specialize in seed production. The members of these CIALs had been trained on seed production, had prior experience on seed production, and received constant supervision and assistance from the NGOs to guarantee the quality of the seed.



Acronyms: *ICTA = "Instituto de Ciencia y Tecnologia Agricola"; MAGA = "Ministerio de Agricultura, Ganaderia y Alimentacion"*
SNEA = "Servicio Nacional de Extension Agricola"

* A "Promotor" is a village leader and farmer who knows village residents and have been trained by the BTD project (excludes "Promotores" from farmer associations)

Figure 5.2. Guatemala: BTD project seed production and supply map, Years 1 and 3.

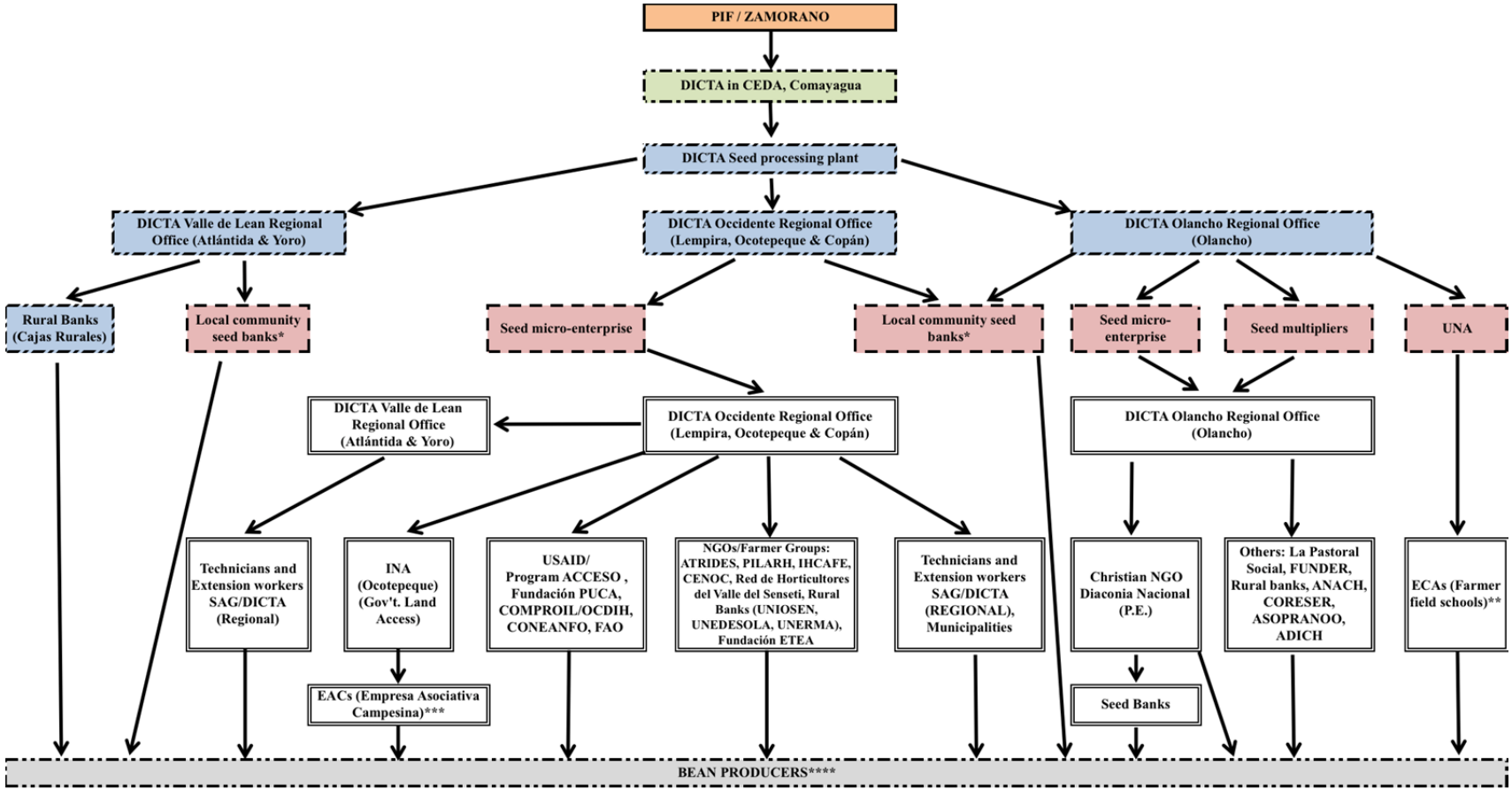


See Acronyms in the "Key to Abbreviations" section of the report

*Bean producers also include members of the different groups (e.g., CIAL members) or farmers who are assisted by different NGOs/Government Units

**CARE's beneficiaries who receive seed thru local organizations all are members of rural banks

Figure 5.3. Honduras: Zamorano BTD project seed production and supply map, Year 2



See Acronyms in the "Key to Abbreviations" section of the report

*Local community seed banks in all Departments distribute seed to their members only. However, in Occidente, they also distribute seed to farmers in neighboring communities and in Olancho they also distribute seed to ECAs (farmer field schools)

**ECAs distribute seed to their members only

***EAC received quality-declared seed and produced more seed before distributing to EAC members and non-members

****Bean producers also include members of the different groups (e.g., seed bank members) or farmers who are assisted by different NGOs/Government Units

Figure 5.4. Honduras: DICTA BTD project seed production and supply map, Year 2

While FIPAH disseminated quality-declared seed with 48 CIALs in two regions in 2012, it produced quality-declared seed only with 16 CIALs. Similarly, PRR distributed seed with 21 CIALs but produced quality-declared seed only with 15 CIALs and CARE distributed seed with 10 CIALs but produced quality-declared seed only with 5 CIALs. Once the quality-declared seed was harvested, it was transported to collection centers (generally located at the NGO headquarters or the CIAL association) for conditioning, then distributed to farmers either directly or thru the CIALs or other organizations. Further, some CIALs were able to sell seed to other type of farmer organizations that then distributed/sold this seed to its members. In 2012, the average weight of a bag of seed that was distributed by Zamorano and its partners was 17 lbs/farmer.

The collaborative work between Zamorano, two of the NGOs (i.e., FIPAH, PRR), and the CIALs started in the late 1990s (the collaboration with CARE started in 2012 and with the other NGOs also started recently). Thus, over the years, these organizations have built a solid relation based on trust and common interests. One of the advantages is that the staff in these organizations has held its job all these years (job security), contrary to what happened in SNEA in Guatemala in 2012. Further, while Zamorano provides technical and financial assistance to the CIALs and NGOs, the NGOs also have their own resources to assist CIAL members with their many other activities.

DICTA. Zamorano provided Foundation seed to DICTA. Figure 5.4 illustrates DICTA's partners for Year 2. The Foundation seed was used to produce Registered seed at DICTA's CEDA facilities in Comayagua. Then, the Registered seed was transported to DICTA's seed plant located at DICTA's headquarters in Tegucigalpa for conditioning and bagging, and it was later transported to DICTA's regional offices. The regional offices used the Registered seed to produce the Quality-declared seed (with a quality equivalent to Certified seed, but without going thru the certification process). In 2012, this activity was done using different types of seed producers, including seed micro-enterprises, seed multipliers (or producers), local seed banks and a university (UNA). In some cases, the Registered seed was directly distributed to bean producers thru rural banks.

Once the quality-declared seed was produced, in most cases it was transported back to DICTA's regional offices for distribution thru a network of partners, which included NGOs (e.g., ACCESO, ETEA), governmental organizations (e.g., INA, SAG), farmer associations or rural banks (e.g., ECAs, IHCAFE, UNIOSEN, COMPROIL, FUNDER, PILARH), farmer field schools, seed banks, and religious groups (e.g., DIACONIA NACIONAL, OCDIH). DICTA's regional office in Occidente produced seed for DICTA's regional office in the Valle de Lean because seed could not be produced in the latter region due to adverse environmental conditions (high humidity and temperature). DICTA's staff constantly supervised seed production to guarantee its quality (Table A5.1). In 2012, the average weight of a bag of seed that was distributed by DICTA and its partners was 21 lbs/farmer. As Figure 5.4 illustrates, similar to the case in Guatemala, once the Quality-declared seed left DICTA's regional offices, no partner used this seed to produce more seed.

Since all of DICTA's partners had their own human and financial resources, the seed of the BTD project was a complement to their activities. Among the three DICTA's regional offices, the one in the Valle de Lean appeared to have the fewest resources. Further, as Figure 5.4. shows, this regional office had the fewest partners and its main two partners were CSBs (in the Department of Atlántida) and rural banks (in the Department of Yoro). In contrast, the regional office in Occidente had the most partners. While the CSBs in the Department of Atlántida had little experience in seed production (since it's not common to produce seed in this department), the rural banks in the Department of Yoro had more experience in this area. Despite this, there is a need to train rural bank members on seed production and also marketing.

Although all partners in Honduras (both for Zamorano and DICTA) had the liberty to select the beneficiaries who would receive seed, these institutions provided the criteria to identify beneficiary

communities and beneficiary farmers. As in Guatemala, the beneficiary communities were selected because of their high poverty rate, food insecurity, were communities already being assisted by the partners (on-going collaboration), and/or were bean-producing communities. Further, beneficiary farmers were selected because they were bean producers, smallholder farmers, already assisted by the partners, and food insecure.

Although Figures 5.3 and 5.4 illustrate the BTD project partners and their role in Honduras in Year 2, these figures are also a good representation of how the seed was distributed in the other two years of the project (albeit some partners were different). The authors did not collect detailed information about Year 1 and Year 3 partners since this was out of the scope of this study.

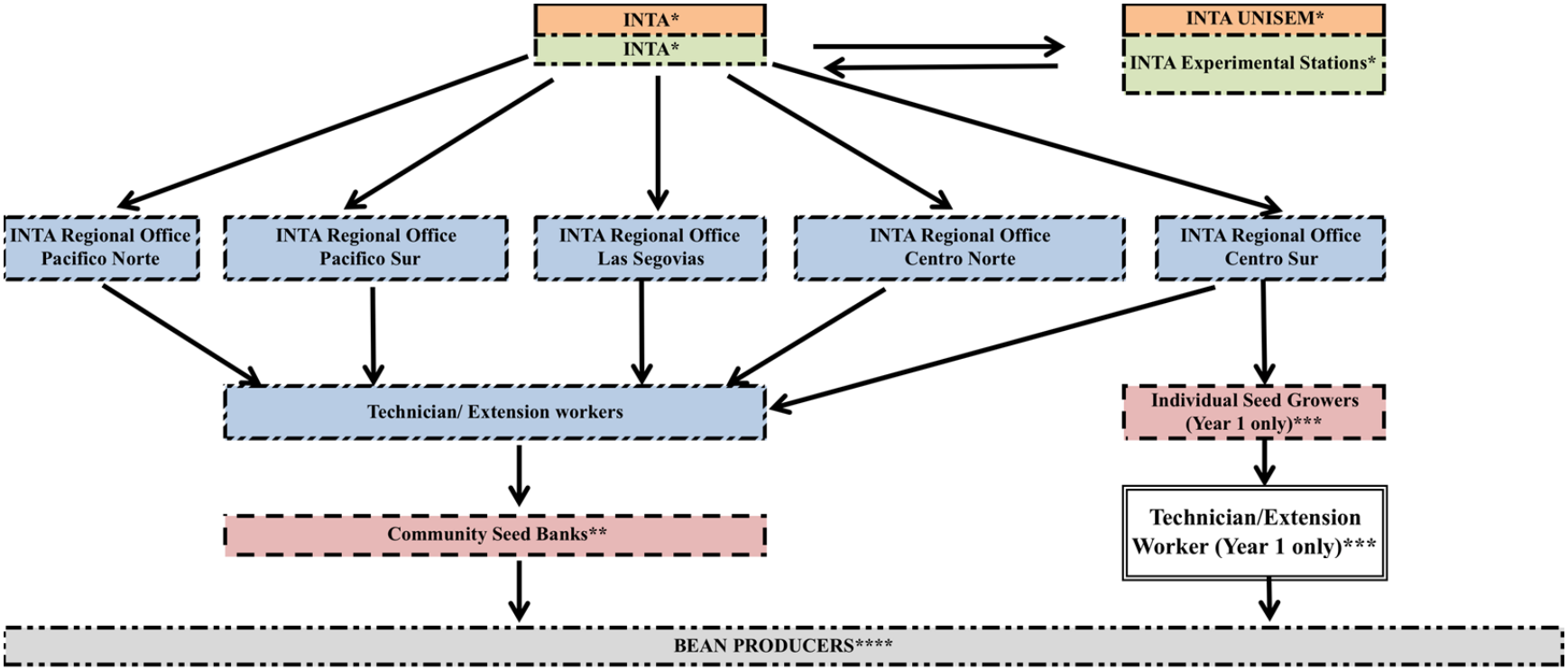
Nicaragua

The main implementing partner in Nicaragua in all three years of the project was INTA. Figure 5.5 illustrates the collaboration between the divisions and regional offices of INTA to produce and disseminate seed of the BTD project, in collaboration with community seed banks (CSBs).

Registered seed was either produced from Foundation seed supplied by Zamorano to INTA (mostly in Year 1) or, for varieties with an existing stock of Basic seed within INTA, the Registered seed was produced from these existing stocks. INTA's UNISEM (seed unit) provided Basic seed when available and assisted to produce Registered seed. Registered seed was produced within INTA's headquarters or its experimental stations. This seed was then transported to INTA's regional offices for distribution to community seed banks or individual seed growers, which used this seed to produce quality-declared or *Apta* seed. Each of INTA's five regional offices coordinated the selection, organization and training of the 40 CSBs that were to produce quality-declared seed for the project. Simultaneously with the Registered seed, the regional offices also distributed an input package to all CSBs that produced quality-declared seed.

Extension workers (also called technicians) from the regional offices worked directly with a representative of each CSB, called the "*promoter*." The organizational strategy to use a technician from INTA and a promoter as a representative of the community is not unique to the BTD project. For example, 23 technicians were employed by INTA in March 2012 in the Pacífico Norte region to assist 10 communities. The main objective was to organize, in collaboration with the promoter, 20 farmers within each community who were to be trained in different agricultural topics and motivate them to participate in other agricultural projects.

The nature of the work under the CSB model was such that, while the promoter and technician learned and communicated the technical knowledge required to produce quality-declared bean seed, a board of directors was to be formed in each CSB to administer operations. Regular meetings between the board and CSB members served to collectively make decisions about the administration and the seed production and dissemination process. Under the BTD project, each CSB was instructed to disseminate sealed and labeled packages containing 20 pounds of quality-declared seed to at least 50 farmers within the community. The CSBs were encouraged to establish payment agreements where beneficiary farmers needed to pay back to the CSB two pounds of grain (or cash equivalent) for every pound of seed received. The income generated from seed sales was to form the working capital needed to continue the CSB's activities at the conclusion of the BTD project's support.



* Aurelio Llano has noted that Genetic Seed is produced by UNISEM of INTA, Basic Seed produced at Experimental Stations of INTA and Foundation Seed comes from Zamorano or International Seed Centers like CIAT

** Community Seed Banks are formed of several community members

***Individual Seed Growers also are counted as Community Seed Banks. In Year 1, INTA extension workers transported seed to other communities and returned payment to the CSBs. Due to the difficulties of transporting seed and facilitating payment, the Centro Sur region used the same model as the other regions in Year 2 and Year 3

****Bean producers also include members of the Community Seed Banks

Figure 5.5. Nicaragua: BTD project seed production and supply map, Years 1, 2 and 3

Finally, the distribution of quality-declared seed to bean producers (i.e., beneficiary farmers) was done either directly by the CSBs or through coordination with INTA's regional staff. In the project's first year (2011), the INTA office in the Centro Sur region played an active role in packaging, transporting and collecting payment of quality-declared seed. The efforts to disseminate seed beyond the community where the CSB was established proved to be costly financially (since it was difficult to enforce the payment agreements) and caused tension between INTA staff and seed recipients who did not agree with the payment terms. Because of this, in subsequent years, this arrangement was discontinued.

5.b. Background of respondents and main steps required to implement the BTD project

Tables A5.1-A5.5 include details on the background of all types of respondents (i.e., project coordinators and sub-coordinators, seed producers, technicians/extension workers, and CIALs/farmer groups) and a description of CSBs and CSBs' members. Because the questions included in the questionnaires were different for Guatemala and Honduras than for Nicaragua, the discussion for Nicaragua is presented after the discussion for Guatemala and Honduras. To keep this document short, only the main characteristics of these collaborators are discussed next.

Coordinators and sub-coordinators. While twenty-two percent of coordinators and sub-coordinators in Guatemala reported having experience on seed production, management and distribution prior to the BTD project, a much higher share (70%) of these informants in Honduras reported the same, with an average of seven years of experience in each country (Table A5.1). The share of the time devoted to the BTD project by these informants was higher in Guatemala (35% of their time) than in Honduras (23%). As expected, providing training to project collaborators was common.

These informants reported that having non-contractual arrangements with partners/collaborators was more common than having contracts with them. While non-contractual arrangements were more efficient than contractual arrangements in Guatemala (67% vs. 50%, respectively), this was not the case in Honduras, where all contractual arrangements were efficient and a small share (22%) of non-contractual arrangements were not efficient. The main reasons why non-contractual arrangements were not efficient were different for Guatemala than Honduras. While these reasons were related to needing additional training and technical assistance in Guatemala, in Honduras these were related to needing more incentives for participants and late seed deliveries (Table A5.1).

In both Guatemala and Honduras, these informants mentioned that the main steps required to implement the BTD project included establishing alliances with partners, identifying beneficiary communities and beneficiary farmers within these communities and providing training to partners' staff. Further, in Honduras, it was also required to sign a commitment letter between Zamorano and DICTA, produce enough basic and foundation seed for all partners in Honduras and other countries, financially support some partners and in one case, hire part-time staff for the project.

Seed producers. While none of the seed producers in Guatemala reported producing bean seed prior to the BTD project, 43% of seed producers in Honduras had previous experience in producing seed, with an average of three years of experience (Table A5.2). Not surprisingly, none of the seed producers in both countries had a processing plant. This was not an issue since in Guatemala, ICTA was responsible for processing the seed in its seed plant at its headquarters and in Honduras, DICTA did the same at its headquarters or in regional offices. Further, the seed that was produced by Zamorano and its partners was processed by the CIALs in regional locations (generally with small manual equipment or by hand) or manually by each partner (including Zamorano).

While storing seed in sacks, over a wood pallet was more common in Guatemala, storing seed in silos was more common in Honduras. In both countries, some seed producers started to produce seed for the BTD project in Year 1, others in Year 2 and in Honduras, a small percentage started producing seed in Year 3 (when the interviews took place). Further, while none of the seed producers in Guatemala produced seed for other projects in Year 2, 43% of respondents in Honduras reported producing seed for other projects/purposes. Finally, 50% of seed producers in Guatemala and 71% in Honduras reported receiving training about seed production from the project (Table A5.2).

CIALs/farmer groups (only Honduras). These types of partners were a special case because they both produced and distributed seed for the project. Thus, they were analyzed separately. One in four respondents reported producing bean seed prior to the BTD project, with an average of three years of experience (Table A5.2). While using silos to store seed was the second most used method by other seed producers in Honduras, silos were the most common method used to store seed among CIALs/farmer groups. Although most CIALs/farmer groups started producing seed for the project in 2012, 38% also produced seed in 2011. In contrast to other seed producers in Honduras, only 25% of CIALs/farmer groups produced seed for other projects, and among those, more than 50% of the seed they produced was for other projects. Further, 75% of CIALs/farmer groups reported receiving training about seed production from the project (Table A5.2).

Technicians/extension workers. On average, extension workers were ten years older in Honduras (average age of 44 years) than in Guatemala and a higher share (90% in Honduras vs. 71% in Guatemala) were male (Table A5.3). While extension workers in Guatemala had worked in the region for more than 13 years, only five in the current institution, extension workers in Honduras had worked in the region almost half the number of years than in Guatemala, most of these (6 years) in the current institution. As expected, all extension workers in both countries distributed bean seed from the project in Year 2 (since only informants who collaborated in the project in Year 2 were sampled).

Community seed banks (CSBs). Table A5.4 provides descriptive statistics of sampled CSBs. From 200 CSBs that were considered for the survey of CSBs (i.e., all CSBs), 153 CSBs submitted completed surveys, indicating a seventy seven percent return rate. As seen in the table, on average, 55% of the sampled CSBs were first established in 2011 (Year 1); however, the share of CSBs that reported this year as their year of establishment was higher in all other regions compared to the Centro Sur region. Since many CSBs were individual farmers instead of a structured CSB (with several members), it is no surprise that three out of four CSBs did not provide information about the first year the CSB was established in this region. Further, a small share of CSBs reported being established before the BTD project started, none of these was in the Centro Sur region. On average, thirteen community members were part of the CSBs when it was formed or established. However, CSBs in the Centro Sur region reported fewest (nine) founding members at the time the CSB was established.

INTA coordinated regional training of technicians and CSB representatives to form CSBs and produce quality-declared bean seed. With the exception of the Centro Sur region, ninety four percent of the sampled CSBs reported receiving training on how to form a CSB, compared to only 31% in the Centro Sur region. The difference may be explained by the presence of existing seed producing groups and the Centro Sur region's decision to produce quality declared seed with individual seed producers (i.e., CSBs were formed by only one farmer), as opposed to CSBs formed by more than one farmer (Table A5.4). Across all regions, 95% of sampled CSBs reported receiving seed production training, 79% reported receiving training on post-harvest seed treatment, handling and storage practices, and eight percent reported receiving training on administrative and financial management practices. Finally, 23% of sampled CSBs received training on seed marketing (Table A5.4).

CSB Members. The individual characteristics of 1,087 CSB members were also provided within the survey of CSBs. However, 28 CSBs submitted individual information of only one CSB member (as opposed to all members) and an additional 33 CSBs did not provide individual information of any of its members. Table A5.5 summarizes the general characteristics of individual CSB members.

While eighteen percent of the CSB members were between 18 and 30 years old, more than half of the CSB members were between 31 and 50 years old and 24% were between 51 and 65 years old. A very small share of members was outside these age ranges. Further, most CSB members were male (79%). The education level of CSB members was low. Sixty three percent of CSB members did not complete primary school and only 24% completed primary school. Finally, having relatives participating in the CSB was common since 42% percent of the CSB members reported having an immediate family member participating in the CSB and 27% reported having a close relative in the CSB (Table A5.5). While immediate relatives were defined as siblings, parents and children, close relatives included grandparents, uncles, aunts, nieces, nephews and cousins.

5.c. Quality of the seed distributed by the BTD project and seed accessibility/service

The success of this type of initiatives depends on many factors, including the quality of the seed that is produced and distributed and its accessibility and service. If the quality is low, farmers will not want to plant the seed and they will not differentiate the seed from the grain in terms of quality. Additionally, the high-quality seed needs to be available at a place and time when farmers need it, and needs to be distributed in a way that farmers can put a (higher) value to the seed compared to the grain they re-use/purchase from markets. That is, the seed needs to have added value in terms of its quality, packaging and availability across time and space. Next we discuss these two principles for a sustainable high-quality, low-cost seed system in the seed models implemented by the BTD project.

First, we start discussing general seed production practices implemented by groups/individuals producing seed for the project in Guatemala and Honduras in Year 2 (Table 5.1). Further, for Honduras, since there were individual seed producers and CIALs/groups of farmers producing seed for the project, the discussion distinguish between these two types of seed producers. Then, we discuss seed packaging practices in Nicaragua. Finally, we end this section with a discussion about the perceived seed quality, from the supply's perspective based on the feedback these partners received from beneficiary farmers, and seed availability in all three countries.

Seed production practices in Guatemala and Honduras

Although only one of the two seed producers in Guatemala reported doing a germination test to the seed they received, all sampled seed producers in Honduras did a germination test to the seed received. Among those who did a germination test, while none complained about poor seed germination in Guatemala, between 14% and 25% in Honduras said that the germination of the seed was not good. This was surprising since when asked whether the seed germinated uniformly once it was planted, everyone reported that the seed germinated uniformly. Further, nearly all said that the flowers had the same color, and most said that the crop matured uniformly (Table 5.1). All these are some of the components that determine the quality of the seed, which overall was good. While applying fertilizers and pesticides was common, irrigating the crop was not--it was more common among individual seed producers in both countries and less common among CIALs/farmer groups in Honduras. Finally, while all seed producers in Guatemala signed a contract with ICTA to produce quality declared seed at an average price of Quetzales 525 per quintal (roughly $68/qq) and more than half of seed producers in Honduras also signed a contract (mostly with DICTA) at an average price of Lempiras 1,538 per quintal (roughly $80/qq), none of the CIALs/farmer groups signed a contract to produce seed. The latter was possible because these groups would directly distribute seed to beneficiary farmers and get paid either in cash or in kind (mostly with grain, after harvest).

Table 5.1. Seed production practices by groups producing seed for the Bean Technology Dissemination (BTD) project in Year 2.

Seed production practices (% yes)	Guatemala	Honduras	
	Seed producers (N=2)	Seed producers (N=7)	CIALs/Farmer groups (N=8)
Did you do a germination test prior to planting the seed?	50	100	100
If YES, was the germination good?	100	86	75
Did the seed germinated uniformly once planted?	100	100	100
When flowering, were the flowers all of the same color?	100	100	75
Did the crop mature uniformly?	100	86	88
Did you apply fertilizers to this crop?	100	100	100
Did you apply pesticides to this crop?	100	100	100
Did you irrigate this crop?	50	57	38
Did you sign a contract to produce the project's seed?	100	57	0
If YES, price per quintal (100lb) (Local currency)	525	1,538	

Sources: BTD Project's Key Informant Interviews (2013)

Seed packaging practices in Nicaragua

In Nicaragua, information about seed packaging practices, seed quality, demand for seed and intention to continue the following year with the project, summarized in Table 5.2, was received from all regions except the Centro Sur region. Thus, the following discussion refers to all other regions except the Centro Sur region. Although including labels on the seed packages is extremely important to differentiate seed from grain and to provide useful information (such as the variety name) to the end-user, only one-half of the sampled CSBs in these four regions reported disseminating seed in packages with labels (Table 5.2). Of those that did include a label, 95% included the name of the variety on the label, 76% reported the result of the germination test, 81% indicated the weight of the package, and 55% provided the date of seed production. The fact that many CSBs did not include a label with the seed package is alarming since the BTD project provided funds for labels and proper seed packages. However, given that only 23% of the CSBs (see table A5.4) received training on marketing seed, this does not come as a surprise since CSB members may not see the importance of presenting their seed and its quality with a labeled package. This is something that needs careful consideration (and follow up) in future initiatives like this one.

Perceived seed quality and seed availability

For the Nicaraguan CSB model to be replicated either in Nicaragua or elsewhere, the CSBs must demonstrate its ability to produce high-quality seed. The same applies to all other seed-production models implemented in other countries. To consider a seed produced by local producers as of high quality, Araya and Hernández (2007) present minimum standards that need to be met, including a maximum humidity content of 15%, physical purity of at least 97.5%, and a minimum germination rate of 80%.

In Nicaragua, while the CSBs reported an acceptable germination rate in Years 1 and 2, the average humidity content and average physical purity rate in Year 1 did not meet these standards (Table 5.2). However, from the 96 CSBs that reported the humidity content, only 14 CSBs reported humidity content above 15%. Thus, this standard should not be a concern since only a few CSBs are driving the mean up and with proper training this could be easily solved. In contrast, from the 85 CSBs that reported a physical purity rate, only 23 CSBs reported physical purity of at least 97.5%, which should be a concern and something that needs improving if this model is to be implemented in other countries. Better crop management, post-harvest management (e.g., better selection of the harvested seed to remove grain that

show damage, contrast in color or signs of germination or fungus) and storage and packaging practices could help to improve the physical purity rate.

In Nicaragua, most (74%) CSBs reported receiving positive feedback from beneficiary farmers who received seed (Table 5.2). These farmers commented positively about the seeds' high germination rate, resistance to adverse climate effects and resistance to common diseases. However, 22% of CSBs reported receiving a mixed feedback about the quality of the seed from farmers and a small (4%) reported receiving negative feedback. Among the 26% of CSBs who received mixed or negative feedback about the quality of the seed, 54% reported farmers were dissatisfied with the variety they received, which was understandable since in Year 1 only one variety (INTA Rojo) was distributed in Nicaragua; 35% reported low market price as an issue; and 23% said farmers complained about the low quality of the seed.

Table 5.2. Seed packaging practices, seed quality, demand for seeds and intention to continue by sampled community seed banks (CSBs) collaborating in the Bean Technology Dissemination (BTD) project in Nicaragua in Year 1.

Details	Seed producers in*		
	PN, PS, LS and CN (N=113)	CS (N=40)	National
Seed packaging practices (% yes)			
Did the seed packages include labels?	49	n.a.	--
Did the label include the name of the variety?	95	n.a.	--
Did the label include the result of the germination test?	76	n.a.	--
Did the label include the weight of the package?	81	n.a.	--
Did the label include the production date?	55	n.a.	--
Seed quality-tests results (%)			
Average germination rate for 2011**	89	87	88
Average humidity rate after drying for 2011	16	n.a.	--
Average purity/acceptable seeds rate for 2011	90	n.a.	--
Average germination rate for 2012***	89	n.a.	--
Beneficiary farmers' opinion about the quality of the seed, as reported by the CSBs (%)			
Positive	74	n.a.	--
Mixed	22	n.a.	--
Negative	4	n.a.	--
Reasons for Mixed or Negative opinion:			
Did not like the variety	54	n.a.	--
Low market price due to (dark) color of the seed	35	n.a.	--
Low germination rate or poor seed quality	23	n.a.	--
Demand in the Community (% yes)			
Could the CSB satisfy the demand for the variety in its community?	40	53	43
Did the community request bean varieties not offered by the CSB?	50	47	49
Sustainability (% yes)			
Will the CSB continue in Year 2 (or 2012)?	80	n.a.	--

Sources: BTD Project's Survey of CSBs

* Country regions: PN = Pacífico Norte; PS = Pacífico Sur; LS = Las Segovias; CN = Centro Norte; CS = Centro Sur.

** Only 7 CSBs from Centro Sur reported Germination Rate for 2011 (i.e., N=7 for this variable).

*** Only 83 CSBs from CN, LS, PN and PS reported Germination Rate for 2012 (i.e., N=83 for this variable).

n.a. = not available or missing responses. See note in section 4.c.ii.

-- = Could not be estimated since there were no data for the Centro Sur region.

Despite the largely positive feedback received from beneficiary farmers in 2011, only 43% of CSBs reported being able to satisfy the demand for seed in their community (Table 5.2). This was surprising since most CSBs reported lower than expected dissemination rates (as indicated by the share of seed produced that was distributed) and thus retained more seed for the CSB than the project planners anticipated. Further, although there was a general satisfaction with the quality of the seed received from the CSBs in Nicaragua in Year 1, almost one-half of the CSBs reported requests for bean varieties not offered by the project. The CSBs could play an important role in discovering which varieties have high demand in their communities and use this information to request Registered seed of the demanded varieties from the national seed authorities and bean breeders to satisfy such demand for quality-declared seed. In Nicaragua, most CSBs reported they would continue in Year 2 with the project.

In Guatemala and Honduras, most of the coordinators and sub-coordinators interviewed reported that they received feedback from farmers about the quality of the seed that was distributed (Table 5.3). In these two countries, all these respondents reported that farmers were satisfied with the quality of the seed they received, which is encouraging since it means that seed producers and all partners did a good job in guaranteeing the quality of the seed along the supply chain. However, while all coordinators and sub-coordinators in Guatemala reported that farmers were also satisfied with the varieties they received, only 75% of them said the same in Honduras. Some farmers in Honduras were not satisfied with the varieties because they did not perform well in their fields. This suggests that this type of projects should classify the regions where they will work and distribute IVs adapted to/demanded in these particular regions so farmers could be convinced of their potential and become permanent adopters of IVs.

Other types of informants were also asked whether farmers were satisfied with the varieties they received. Their responses differ from the answers provided by coordinators and sub-coordinators (Table 5.3). Although all coordinators and sub-coordinators in Guatemala reported that farmers were satisfied with the variety they received, only 93% of extension workers reported the same in this country. The reason for this was that some farmers did not like the varieties because they said these were not adapted to their environment and did not perform well (i.e., low yields). Despite this, the fact that more than 90% of all types of respondents agreed that farmers liked the varieties they received is noteworthy. In contrast, although a small share of coordinators & sub-coordinators in Honduras said that some farmers were not satisfied with the varieties received, none of the extension workers or CIALs/farmer groups reported this

When asked whether the amount of seed distributed per farmer was adequate, two out of three extension workers in Guatemala and the same share of CIALs/farmer groups in Honduras reported that the amount of seed distributed per farmer in Year 2 was adequate. In contrast, less than one-third of extension workers in Honduras reported that the amount of seed distributed per farmer in Year 2 was adequate (Table 5.3). While many of these respondents reported that farmers wanted more seed, some extension workers said that the amounts were adequate for some farmers but inadequate for others.

For a seed model to be sustainable, in addition to producing high-quality seed, the seed needs to be available in the right place at the right time. This depends on many factors, including the resources at hand, the number of villages each person is required to assist, the distance between the storage place and the place where the seed is distributed, whether the same person has other responsibilities that conflict with this initiative (e.g., distributing seed for other projects), and whether it is required to provide seed to new beneficiaries every time (since more time needs to be devoted to finding new beneficiaries). The average number of villages each extension worker/technician distributed seed to was highest (20 villages/ person) in Honduras, followed by Guatemala (11 villages/person) and far behind by CIALs/farmer groups (5 villages) in Honduras (Table 5.3). Although the number of villages reached by CIALs/farmer groups in Honduras seems small, the CIALs/farmer groups generally do not visit other villages to distribute seed because they don’t have the human and financial resources to do so. Instead, farmers from nearby villages generally visit these groups to obtain/purchase the seed.

Table 5.3. Bean Technology Dissemination (BTD) beneficiary farmers' perceived satisfaction with the seed and seed availability in Year 2.

Details	Guatemala		Honduras		
	Coordinators & Sub-coordinators (N= 8)	Technicians/ Extension workers (N=15)	Coordinators & Sub-coordinators (N= 10)	Technicians/ Extension workers (N=11)	CIALs/Farmer groups (N=8)
Perceived satisfaction with the seed and amount received (% yes)					
Did your institution receive feedback from farmers about the quality of the seed?	100	n.c.	89	n.c.	n.c.
If YES, were they satisfied with the quality?	100	n.c.	100	n.c.	n.c.
If YES, were they satisfied with the variety?	100	n.c.	75	n.c.	n.c.
Were beneficiaries satisfied with the variety they received?	n.c.	93	n.c.	100	100
Was the amount distributed per farmer adequate? (%):					
Yes	n.c.	67	n.c.	28	67
No, they wanted more seed	n.c.	20	n.c.	36	33
Yes and No	n.c.	13	n.c.	36	0
Availability/service					
Average number of villages where you/this group distributed seed	n.c.	11	n.c.	20	5
Place where seed was distributed to farmers (%):					
Farmers traveled to the place where the seed was stored	n.c.	27	n.c.	0	80
I took the seed to the communities/villages	n.c.	27	n.c.	36	0
Other place in between storage and villages (everyone needed to travel there)	n.c.	13	n.c.	18	0
Combination of 2 or 3 of the options listed above	n.c.	33	n.c.	36	20
Other distribution place not listed above	n.c.	0	n.c.	9	0
Average distance (km) to place where seed was distributed	n.c.	54	n.c.	79	1
Did you distribute seed of other projects/institutions in 2012-13?	n.c.	13	n.c.	73	25
Were the beneficiaries the same as in the previous year? (%):					
Yes	n.c.	0	n.c.	10	0
No	n.c.	0	n.c.	40	0
Some were the same	n.c.	7	n.c.	10	38
I did not distribute seed in 2011-12	n.c.	93	n.c.	40	63

Table 5.3 (continued)

Details	Guatemala		Honduras		
	Coordinators & Sub-coordinators (N= 8)	Technicians/ Extension workers (N=15)	Coordinators & Sub-coordinators (N= 10)	Technicians/ Extension workers (N=11)	CIALs/Farmer groups (N=8)
Was the seed distributed on time for planting? (%):					
Yes	n.c.	53	n.c.	55	83
No	n.c.	0	n.c.	27	17
Yes and No	n.c.	47	n.c.	18	0

Sources: BTD Project's Key Informant Interviews (2013)
n.c. = data not collected

In Guatemala and Honduras, the seed was distributed in many places, some involved the supplier to transport the seed, in others both the suppliers and the beneficiaries needed to transport the seed and in other cases it was the beneficiary who picked up the seed from the storage place (Table 5.3). Not surprisingly, it was more common for farmers who received the seed from CIALs/farmer groups to pick up the seed from the storage place (which generally is within the community). On average, extension workers/technicians distributing seed needed to transport it 54 km in Guatemala and 79 km in Honduras. In contrast, CIALs/farmer groups only transported the seed one kilometer (Table 5.3).

While only 13% of extension workers in Guatemala and one out of four CIALs/farmer groups in Honduras distributed seed for other projects in Year 2 (in addition to the BTD project), almost three out of four extension workers in Honduras distributed seed for other projects (mostly the government program) (Table 5.3). It is remarkable that, although most extension workers in Honduras reported also distributing seed for other projects, they distributed seed in more communities than extension workers in Guatemala.

The majority (93%) of extension workers in Guatemala did not distribute seed for the project in Year 1 (Table 5.3). This was expected since the 2012 seed distribution model (and partners) was (were) completely different than the model used in Year 1 (where seed was distributed thru SNEA). For the few extension workers who distributed seed in Year 1, they reported that some of the beneficiary farmers were the same in both years (i.e., some farmers received seed from the BTD project in 2011 and 2012). In contrast to Guatemala, in Honduras only 40% of extension workers and 63% of CIALs/farmer groups reported not distributing seed in the first year of the project, which confirms that many of the partners in 2012 also collaborated in the project in 2011. Further, 10% of extension workers in Honduras and 38% of CIALs/farmer groups said that the beneficiary farmers received seed both years.

Given that, with the exception of CIALs/farmer groups, the number of villages each extension worker/technician was required to assist was relatively high, that the seed needed to be transported large distances to be distributed and that many of the extension workers also distributed seed for other projects (especially in Honduras), it is no surprise that late seed delivery was reported as an issue across countries. Only 53% of extension workers in Guatemala and 55% in Honduras reported that the seed was distributed on time for planting.[4] Late seed deliveries appeared not to be an issue among CIALs/farmer groups since 83% of these respondents reported that the seed was distributed on time for planting (Table 5.3).

In Nicaragua, late seed deliveries also appeared not to be an issue for CSBs. Maredia, Reyes and DeYoung (2014) report that only 10% of the 480 sampled farmers reported receiving seed after the date they anticipated planting and 80% reported receiving the seed at least a week before the anticipated planting date. However, several CSBs, including all in the Pacífico Norte region, mentioned receiving inputs and seed from INTA later than the ideal planting time in their area in Year 1. Despite this, the CSB provided the seed to 90% of its recipients prior to their anticipated planting date.

In the case of the CIALs/farmer groups in Honduras and the CSBs in Nicaragua, the reason why these were better prepared to distribute the seed on time for planting to beneficiary farmers was the proximity of these groups to the farmers. Further, this proximity allows these groups to easily condition the seed despite the limited time available for this activity between when the seed is harvested and when is needed for planting.

Despite this, late seed deliveries should be avoided since farmers who receive the seed late could a) plant the seed in his/her only available field (perhaps of low quality or a field with weeds that was not ready for

[4] Since some respondents reported that in some cases the seed was distributed on time for planting and in others not, these reported shares should be taken as a conservative estimate.

planting), b) store the seed until it is planted in the following season (with the risk of losing the quality of the seed due to poor storage conditions), or c) use the seed for other purposes (e.g., eat it, sell it). Although there were some issues with late seed deliveries, it is remarkable that more than 50% of extension workers/technicians in Guatemala and Honduras said that the seed was delivered on time for planting, despite the extremely limited amount of time available to condition the seed between when the seed is harvested and when is needed for planting, and in addition to the limitations previously discussed.

5.d. Quantity of seed distributed by the BTD project and diversity of varieties

Another principle of sustainability of seed systems is being able to meet the demand for seeds and providing diverse varieties that farmers want. The BTD project has distributed high-quality seed of beans to 75,407 farmers in Guatemala, Honduras and Nicaragua over the three years of the project. In Guatemala, the BTD project distributed a total of 177 MT of quality-declared bean seed (with a quality equivalent to Certified seed, but without the certification process) and directly benefited a total of 33,342 farmers in three years (BTD, 2014). While 45 MT of bean seed were distributed to 4,998 beneficiary farmers in 2010-2011, 37 MT of seed were distributed to 7,364 beneficiary farmers in 2011-2012 and 95 MT of seed were distributed to 20,980 beneficiary farmers in 2012-2014. Reaching a large number of beneficiaries in the last year was possible because the amount of seed produced more than doubled and the amount distributed per beneficiary decreased in the last year.

In contrast, in Honduras, the BTD project has distributed a total of 137 MT of quality-declared bean seed (with a quality equivalent to Certified seed, but without the certification process) and directly benefited a total of 26,000 farmers in the lifespan of the project (BTD, 2014). While 42 MT of bean seed were distributed to 4,334 beneficiary farmers in Year 1, 53 MT of seed were distributed to 5,980 beneficiary farmers in Year 2 and 42 MT of seed were distributed to 15,686 beneficiary farmers in Year 3.

In Nicaragua, the project goals were to produce 15 qq of quality-declared seed per manzana-plot established by each CSB and to provide 50 farmers within the community with 20 lbs of seed. The average yield obtained was 12 qq per manzana (mz) in the first year of the project (from 156 CSB-plots) and 11 qq/mz in Year 2 (from 127 CSB-plots), clearly suggesting that the yield goal could not be reached (Table 5.4). Further, to provide 50 farmers within the community with 20 lbs of seed, each CSB needed to produce at least 10 qq or 1,000 lbs of seed. As seen in Table 5.4, only 72 of the 156 CSB-plots (46% of plots) produced 10 qq or more per manzana in Year 1. Centro Sur was the only region where the majority of CSB-plots produced 10 qq or more per manzana in the project's first year.

Despite the low yields from the CSB plots reported in Nicaragua, at the project level the total amount of seed that was produced among the responding CSBs would have been enough to meet the seed goal if close to 100% of this seed had been disseminated to farmers. However, in Year 1, only 56% of the total amount of seed available was distributed to beneficiary farmers, reaching approximately 47% of the total possible number of beneficiaries (Table 5.4). It was anticipated that each CSB would produce 15 qq/manzana and disseminate 10 qq, for a dissemination rate of 67% of the seed produced. Clearly, the 67% dissemination rate was not reached since only 56% of the seed was distributed. INTA regional offices have mentioned that it was difficult to convince CSB members to disseminate the seed to other farmers in their community instead of dividing the seed among CSB members. In Nicaragua, the BTD project distributed a total of 168 MT of quality-declared bean seed in all three years (with a quality equivalent to Certified seed), directly benefiting an estimated total of 16,065 farmers (BTD, 2014).

Despite the total amount of seed that was distributed, the total number of reached beneficiaries in all three countries was lower than anticipated, especially in Nicaragua and Honduras. Further, in Nicaragua, respondents mentioned that the CSBs were not able to meet the local demand for seed.

Table 5.4. Sampled community seed banks' (CSBs') yields, amount of quality-declared bean seed produced and beneficiary farmers. Nicaragua, Years 1 and 2.

Details	Centro Norte	Centro Sur	Las Segovias	Pacífico Norte	Pacífico Sur	Total sample	Projected National /a
Bean yields among sampled CSBs in Years 1 and 2							
All Plots (Year 1 or 2011):							
Number of plots*	37	40	35	22	22	156	200
Seed/planting rate (qq/mz)	0.76	0.82	0.79	0.80	0.80	0.79	--
Average yield (qq/mz), plots with >0 production	13	17	11	12	8	13	--
Average yield (qq/mz), all plots**	12	16	10	12	7	12	--
All Plots (Year 2 or 2012):							
Number of Plots*	44	n.a.	31	32	20	127	200
Average yield (qq/mz), plots with >0 production	12	n.a.	16	10	7	12	--
Average yield (qq/mz), all plots**	12	n.a.	14	10	7	11	--
Plots with yields over 10 qq/mz in Year 1							
Number of plots	18	28	11	11	4	72	156
Share (%) of total plots	49	70	31	50	18	46	--
Average yield (qq/mz) of these plots	19	21	20	17	14	19	--
Seed production and number of bags in Year 1							
Total bean seed production (qq)	481	657	386	231	259	2,014	2,582
Total 20-lb bags possible***	2,405	3,283	1,932	1,157	1,295	10,072	12,912
Beneficiary farmers in Year 1							
Total number of beneficiary farmers	695	1,536	578	903	1,004	4,716	6,046
Share (%) of total possible beneficiaries****	29	47	30	78	78	47	--
Total amount of seed diseminated (qq)	255	329	142	197	203	1,125	1,443
Share (%) of total seed available	53	50	37	85	78	56	--
Average seed received (lbs/farmer)	37	21	25	22	20	24	--

Sources: BTD Project's Survey of CSBs and BTD Project's Record Keeping of CSBs' production costs

a/ Projected national uses the information from the sampled (156) CSBs to estimate what would the information be for all (200) CSBs that participated in the project.

* Accounts for all plots, even ones with crop failure (i.e., zero production). This is the sample size for each year.

** This yield estimation includes plots with >0 production and plots with crop failure (i.e., zero production).

*** Estimated by multiplying "total bean seed production (qq)" times 5 since 5 20-lb bags can be prepared from one quintal (qq).

**** Estimated by dividing the "number of beneficiaries" by the "total 20-lb bags possible."

n.a. = not available or missing responses. See note in section 4.c.ii.

-- = not applicable.

In terms of the diversity of the varieties that were offered to beneficiary farmers, it was in Honduras where most varieties were distributed in all years (BTD 2011, 2012, 2014). While in Honduras DICTA only distributed conventionally-bred bean varieties (i.e., Amadeus 77, Cardenal, Carrizalito, Deorho, and Tío Canela 75), Zamorano, in addition to these varieties, also distributed participatory-bred varieties (e.g., Cedrón, Chepe, Campechano JR). Although the Government of Honduras does not officially recognize these participatory-bred varieties, they are widely grown by farmers in the regions where the CIAL developed them.

In contrast, in both Guatemala and Nicaragua, the number of varieties distributed increased over time from two in Year 1 to four in Year 3 in Guatemala and from one in Year 1 to six in Year 3 in Nicaragua. Further, while the average amount of seed distributed per farmer decreased over time in Guatemala (which allowed reaching more farmers in latter years), the average amount of seed distributed per farmer in Nicaragua varied every year, without a clear trend (BTD 2014).

Finally, the partners who distributed more seed in Year 2 in Guatemala were MAGA-Extension, SOSEP and FONTIERRAS and in Honduras were the NGO PRR, DICTA-Occidente and DICTA-Olancho (Table A5.6). In Nicaragua, all seed was distributed thru CSBs.

5.e. Seed price, payment arrangements between suppliers and beneficiary farmers, and seed recovery

Other principles of sustainability of seed systems, in addition to providing diversity of high-quality seed varieties, with good packaging, at the right place and at the right time (all previously discussed), include the capacity of partners to provide this seed at an affordable price and to be able to recover this investment. For this, seed payment agreements between seed suppliers and beneficiary farmers are key. Next, we discuss these two principles of sustainability (i.e., price and investment recovery).

Since the BTD project generally did not require paying for the seed in cash (unless farmers could afford it) at the time when the seed was distributed, the project was designed in a way that beneficiary farmers would generally receive the seed in credit and pay it back after harvest either with cash (at a price previously determined) or in kind (with grain). Charging for the seed was intended to reduce farmers' expectation of receiving free seed every year and to make the project sustainable in the long-term. Thus, the "price" of the seed was generally a multiple of the price of the grain (e.g., twice the price of grain).

In Guatemala in Year 2, farmers could pay for the seed they received in three ways (Table 5.5): 1) pay one pound of grain for each pound of seed received (lb. x lb.), 2) no payment but needed to give part of the grain harvested to other farmers, or 3) other type of payment, which included a combination or variations of the payment types listed in Table 5.5 (e.g., pay 0.25 pounds of grain for each pound of seed received). The first type of payment was the most commonly used; thus, the price of the quality-declared seed was the same as the price of grain.

While three out of four coordinators and sub-coordinators in Guatemala reported that farmers agreed to this payment arrangement, some of these informants (12.5%) reported that farmers wanted free seed and a similar share of informants (12.5%) reported that farmers did not agree to the payment arrangement (Table 5.5). In contrast, most extension workers (87%) reported that farmers agreed to the payment arrangement, and only 13% of this type of informants reported that farmers did not agree to this payment in Guatemala.

Table 5.5. Bean Technology Dissemination (BTD) Beneficiary farmers' seed payment arrangements in Year 2.

Seed payment arrangements	Guatemala		Honduras		
	Coordinators & Sub-coordinators (N= 8)	Technicians/ Extension workers (N=15)	Coordinators & Sub-coordinators (N= 10)	Technicians/ Extension workers (N=11)	CIALs/Farmer groups (N=8)
How were beneficiary farmers to pay for the seed received? (%):					
Nothing, seed was free	0	0	0	0	0
Cash payment	0	0	10	0	12.5
Return same amount of grain (lb x lb)	75	80	40	18	0
Return twice the amount of grain (2lb x lb)	0	0	10	9	62.5
No payment, but needed to give part of grain harvested to other farmers	12.5	13	0	36	0
Other payment type	12.5	7	40	36	25.0
How did beneficiary farmers react to this payment? (%):					
They agreed	75	87	90	91	87.5
Did not like it, wanted free seed	12.5	0	0	0	0
Wanted to pay for seed, but price was too high	0	0	0	0	12.5
Some agreed, others didn't	12.5	13	0	9	0
Don't know	0	0	10	0	0
About the seed that had a payment different than cash, have you confirmed whether farmers are honoring the payment? (% yes)	86	93	63	73	75
If YES, approximately what share of farmers have paid back?	33	30	71	57	82

Sources: BTD Project's Key Informant Interviews (2013)

In contrast to Guatemala, in Honduras in Year 2, farmers could pay for the seed they received in five ways (Table 5.5): 1) pay in cash, 2) pay one pound of grain for each pound of seed received (lb. x lb.), 3) pay twice the amount of grain (2lb. x lb.), 4) no payment but needed to give part of the grain harvested to other farmers, or 5) other type of payment, which included a combination of the payment types listed in Table 5.5. While coordinators & sub-coordinators reported that payments (2) and (5) were the most common payment arrangements, extension workers reported that payments (4) and (5) were most commonly used. In contrast, among the CIALs/farmer groups, the most common payment arrangement was payment (3) (i.e., to pay two pounds of grain for every pound of seed). As expected, most informants reported that farmers agreed to these payment arrangements. Thus, in Honduras, the "price" of the seed distributed by partners other than CIALs/farmer groups was the same as the price of grain or given for free under the condition that part of the harvest will be shared with other farmers, CIALs/farmer groups charged twice the price of grain for the seed they distributed.

As previously discussed, a common complaint among CSB leaders and extension workers in Nicaragua was the refusal or hesitation of farmers to return grain to the CSB at harvest. Some CSBs anticipated repayment issues and required payment at delivery in the form of seed exchange, cash payment or barter. Other CSBs prepared documents detailing terms of repayment and required the signature of the seed recipient. The involvement of INTA regional staff in the lending process increased farmers' resistance to pay/sign for the seed because of a sentiment that the government should donate seed, not sell it. However, the evidence suggests that this was not the case in all regions since the reported number of beneficiaries who returned 2lbs of grain for each pound of seed (2lb x lb) received in Year 1 was highest in the Centro Sur region where INTA staff involvement was very high (Table 5.6). In Year 2 and 3 of the project, INTA decreased its involvement in selecting seed recipients and collecting repayment due to the difficulties of this activity. Generally, the "price" of the seed was twice the price of grain.

As one can see, in general, the "price" of the quality-declared seed in all three countries was not high, since the most common prices were either the same price as grain or twice the price of grain. Setting a payment arrangement before distributing the seed is a good practice. However, recovering the investments made to produce the quality-declared seed (so the models are sustainable) depends on farmers actually repaying the seed; that is, honoring the payment agreement.

In Guatemala, most coordinators & sub-coordinators and extension workers reported that they have confirmed whether farmers have honored the payment arrangement. Among those respondents who have confirmed this, they reported that roughly only one out of every three farmers has paid back the seed they received (Table 5.5). This is consistent with the beneficiary survey results that show that 71% of farmers who received BTD project seed in 2012 reported that they did not pay for the seed either in cash or in kind (Maredia, Reyes, DeYoung 2014). This low payment rate should be of concern since the idea of repaying the seed was to guarantee working capital so the models can be sustainable in the long term. However, given the limited human and financial resources of the partners involved in the project, it is of no surprise that they could not follow up with farmers to persuade them to honor the agreement. Thus, additional efforts and resources may be needed to stress the importance of repaying the seed for the long-term sustainability of these models.

In contrast, in Honduras, 63% of coordinators & sub-coordinators and 73% of extension workers reported that they have confirmed whether farmers have honored the payment arrangement. Among those respondents who have confirmed this, they reported that between 57% and 71% of beneficiary farmers have paid back the seed they received (Table 5.5), which is much higher than the payment rate observed in Guatemala. The relatively high payment rate reported in Honduras may be an indication that farmers are more committed to the idea of repaying seed because they see the value of it.

nology Dissemination (BTD) Beneficiary farmers' seed payment arrangements among sampled community Nicaragua in Year 1.

	Centro Norte	Centro Sur	Las Segovias	Pacífico Norte	Pacífico Sur	Total sample	Total without Centro Norte
	(N = 37)	(N = 40)	(N = 31)	(N = 23)	(N = 20)	(N = 151)	(N = 114)
	695	1,536	578	903	1,004	4,716	4,021
o returned/paid back the seed *(2)	6	1,128	313	405	640	2,492	2,486
seed distributed (qq)	255	329	142	197	203	1,125	871
d/paid back as grain (qq)	63	376	172	189	202	1,002	938
r forms of repayment"	2	n.a.	56	33	155	245	243
	0.9	73	54	45	64	53	62
	12	57	61	48	50	45	54
	13	n.a.	80	56	88	55	68

urvey of CSBs

lculated as the percent of total beneficiaries who returned 2 lbs. of grain for each pound of seed received (i.e., f = b / a).

alculated as the percent of expected grain (2 lbs. for each pound of seed received) that was repaid to the CSBs (i.e., g = d /

calculated as the percent of the expected grain repaid in grain, cash or other items (i.e., h = [d + e] / [c * 2]).

sing responses.

Additionally, three out of four CIALs/farmer groups in Honduras said that they have confirmed whether farmers have honored the payment arrangement and among those respondents who have confirmed this, they reported that 82% of beneficiary farmers have paid back the agreed price for the seed they received (Table 5.5), which is the highest payment rate in the country and across countries. This may be due to the fact that many beneficiary farmers receiving seed from CIALs, for example, are either CIAL members or know each other very well and may be more inclined to pay the seed back to keep his/her good reputation in the community. Further, is likely that beneficiary farmers see the value of repaying the seed to be able to access more seed in the future.

In Nicaragua, three repayment rates were estimated: 1) Repayment Rate 1, calculated as the percent of total beneficiaries who returned 2 lbs. of grain for each pound of seed received; 2) Repayment Rate 2, calculated as the percent of expected grain (i.e., 2 lbs. of grain for each pound of seed received) that was repaid to the CSBs; and 3) Repayment Rate 3, calculated as the percent of the expected grain repaid in grain, cash or other items. To keep consistency, although information about the three repayment rates is provided in Table 5.6, only Repayment Rate 1 is discussed next. Due to data availability, we could only estimate repayment rates for farmers who repaid 2lb x lb (i.e., Repayment Rate 1). Farmers who may have paid a different amount of grain (e.g., pound by pound) were not included in this rate estimation. Thus, the rate discussed here should be taken as a lower-bound estimate of repayment of seed in Nicaragua and should not be compared to the repayment rate estimates provided for Guatemala and Honduras. Maredia, Reyes and DeYoung (2014) provide repayment rates based on the beneficiary survey for all farmers who repaid the seed in Nicaragua, which is higher (estimated at 95%) than the rate reported here and comparable across countries.

Our results for Nicaragua suggest that 53% of beneficiary farmers returned 2 lbs. of grain for each pound of seed received. Within Nicaragua, this repayment rate greatly varied across regions. While the highest Repayment Rate 1 in Year 1 was observed in the Centro Sur (73%) and Pacífico Sur (64%) regions, the lowest Repayment Rate 1 was observed in the Centro Norte region (<1%). Many CSBs in the Centro Norte region reported exchanging seed pound for pound at the time of distribution instead of disseminating seed and waiting for repayment at harvest and these were not included in Repayment Rate 1 estimations. The average repayment rate 1 excluding the Centro Norte region is 62% (Table 5.6).

Overall, it seems that additional efforts need to be devoted to persuade farmers to honor the payment agreements, if these models are to be sustainable in the long term. Clearly, models that include local partners within the community to produce and distribute the seed have better chance to recover investments made to produce the seed since the highest repayment rate was observed among CSBs/CIALs/farmer groups, which are generally located in the community where the seed is distributed.

5.f. Perceived strengths, weaknesses, constraints, and sustainability of implemented models

Informants were asked about the strengths, weaknesses, constraints and sustainability of the seed dissemination models implemented by the project. For ease of understanding, these responses are discussed next, separately for Guatemala and Honduras. Although this information was not collected for Nicaragua, we present what we consider are strengths and weaknesses, based on the results previously discussed.

Guatemala

Strengths, weaknesses and constraints of the BTD models. Coordinators, sub-coordinators and extension workers were asked about the strengths and weaknesses of the dissemination models implemented by the BTD project in 2012. Additionally, coordinators and sub-coordinators were asked about the constraints that need to be addressed to make these models more efficient in the future. Seed producers, in contrast, were asked about their perceived strengths and weaknesses of the seed production methods implemented

by the project in 2012. Table A5.7 summarizes these responses. To keep the discussion short, only the main points are discussed next.

As the table shows, ICTA's project coordinator reported that working with MAGA and ICTA in the Department of Huehuetenango and the partnership with SOSEP were the best ways to disseminate seed in 2012. This was because their staff was excellent. Further, as Table A5.6 shows, most beneficiary farmers were assisted by MAGA (39%) and SOSEP (17%). This informant reported that the main strength of these distribution models was that the facilities to pool the seed and distribute it were already available (i.e., installed capacity). In contrast, the main weakness of these models was that the seed was not always available in a timely manner where and when it was needed. The latter is key for the success of the project. Further, this informant mentioned that the main constraints that need to be addressed to make these models more efficient in the future are the institutionalization of SNEA (so what happened in 2012- i.e., firing of staff when the new government took office- does not happen again) and the promotion of these initiatives to increase private sector involvement. Although these models were the best for seed distribution in 2012, ICTA's coordinator pointed out that the best seed distribution model overall was distributing seed thru SNEA (2011 and 2013), since the network of extension workers is already established, they can reach many farmers and distributing seed will only be an additional activity to the many activities they already conduct with farmers (thus, the marginal cost of distributing seed is low).

Sub-coordinators noted different models as the best models to disseminate seed, depending on the institution/region they worked for. While ICTA's sub-coordinators indicated working with SNEA (in 2011) and SOSEP (in 2012) as the best models because of the positive attitude of their staff, MAGA-Petén's sub-coordinator listed working with COCODES as the best seed dissemination model because they were able to reach more farmers than normally would thru direct distribution. Further, MAGA-Huehuetenango's sub-coordinator indicated working with SNEA as the best model for seed distribution because the seed reaches farmers directly (as opposed to thru intermediaries, since SNEA staff visited farmers and took that opportunity to distribute seed). In contrast, SOSEP's sub-coordinator mentioned that from the different ways they distributed seed, direct distribution was the best way to reach farmers since they were sure that the seed reached the intended beneficiaries and SOSEP technicians could complement seed distribution with providing technical assistance in the same visit.

Among the main strengths mentioned by more than one sub-coordinator were that the "promotores"/ extension network was already established, the seed reached beneficiary farmers directly (this was mainly reported by government partners who directly took the seed and distributed in the communities), and the installed capacity/good logistics available. As mentioned above, the project coordinator also saw established capacity as a strength of the distribution models.

Among the major weaknesses pointed out by more than one sub-coordinator were the political instability (i.e., SNEA's staff being fired in 2012 by the new government) and the limited financial resources available to distribute the seed. Further, these informants mentioned that other weaknesses included the lack of technical assistance about seed management to farmers (since only seed was distributed) and late delivery of the seed. Providing technical assistance is important because farmers can learn how to manage the seed to maintain its quality over time. Late delivery of the seed was also considered a weakness by the project coordinator.

More than one sub-coordinator mentioned that the main constraints that need to be addressed to make these seed distribution models more efficient in the future were the political instability, need of additional human and financial resources (financial resources especially for transportation of seed and follow up visits) and need to reduce the number of beneficiaries/to focus on fewer regions. Another constraint was the need to better identify potential beneficiaries. This was because even though potential beneficiary

farmers may grow beans, many do not have good environmental conditions to grow beans. Thus, these farmers will most likely obtain low yields, which may discourage them from adopting IVs.

More than one technician/extension worker listed the following strengths as important: partnering with COCODES since these are very active organizations, the BTD project allowed providing seed in communities where partners were already assisting farmers (which complemented their work), the trust that farmers have in these institutions (due to ongoing assistance), the good organization and inter-institutional support among partners, the good quality of the seed, and that the project allowed farmers to access seed of IVs that perhaps they could not access otherwise.

Among the weaknesses listed by more than one technician/extension worker were the need for better planning/organization (e.g., better record keeping of who receives seed), to provide a complete technical package (i.e., fertilizers, technical assistance, along with the seed), and to deliver the seed in the communities as opposed to "promotores" transporting the seed to the communities, since "promotores" lack the necessary resources to do this. Similar to sub-coordinators, extension workers mentioned the inability of the project to train farmers as a weakness. Further, while sub-coordinators mentioned the need to better identify potential beneficiaries as a constraint that needs to be addressed to make these models more efficient, extension workers listed this as a weakness, which highlighted how important this is. Finally, coordinators, sub-coordinators and extension workers all listed late delivery of seed as a weakness.

Seed producers mentioned that one of the main strengths of this project was that their contract with ICTA (to produce seed) allowed them to get cash advances (probably as loans) because they could show that they had a guaranteed market for the seed. One of these informants mentioned that the main weakness was his old irrigation system.

The above results suggest that coordinators and sub-coordinators consider the partnership with SNEA in 2011 and with SOSEP in 2012 as some of the best seed distribution models. Further, the major strengths were the installed capacity of the partners and the seed reaching beneficiary farmers directly (as mentioned above, these partners did not work with other intermediaries to distribute seed). The latter strength is understandable since as more partners are involved, the seed distribution cost will increase and it becomes more difficult to monitor that the seed indeed reaches the beneficiary farmers. The major weaknesses included the late delivery of the seed and the need to provide, in addition to seed, technical assistance to farmers (complete technical package). Finally, the major constraints that could threaten the success of these public-sector led seed distribution models included the need to better identify potential beneficiary farmers, additional human and financial resources, and overcoming political instability.

Sustainability of BTD models. Coordinators and sub-coordinators were inquired about what incentives would be necessary to guarantee the sustainability of the distribution models implemented by the BTD project after the project finalizes and what local organization/institution could be the link between all partners along the seed supply chain. These informants reported that the main incentives were the need for the government to provide more financial resources for the public partners to do the work (especially a larger budget for seed transportation and follow up visits), the need to train extension workers, to guarantee a constant flow of technologies (e.g., IVs) to farmers, and job stability of the staff. Further, these informants mentioned that the best positioned local institution to link all partners in the seed supply chain was ICTA or MAGA, and that partnering with other institutions to distribute seed was necessary.

Honduras

Strengths, weaknesses and constraints of the BTD models. As in Guatemala, coordinators, sub-coordinators, extension workers, and CIAL/farmer groups in Honduras were inquired about the strengths and weaknesses of the public-sector led dissemination models implemented by the BTD project in 2012. Additionally, coordinators and sub-coordinators were asked about the constraints that need to be addressed to make these models more efficient in the future. Seed producers, in contrast, were asked about their perceived strengths and weaknesses of the seed production methods implemented by the project in 2012. Table A5.8 summarizes these responses. To keep the discussion short, only the main points are discussed next.

As the table shows, DICTA's project coordinator reported that working with the regional office in Occidente was the best way to disseminate seed in 2012. This was because he perceived that farmers in this region valued better this assistance because they have seldom received assistance before. Further, as Table A5.6 shows, most beneficiary farmers (23%) were assisted thru this regional office. In contrast, Zamorano's project coordinator considered that working with PRR and FIPAH were the best dissemination models in 2012. The reasons were that these NGOs are already organized (i.e., they have been working in the region for many years) and the good relationship existed between Zamorano, the NGOs, and the farmers they assist. Not surprisingly, PRR assisted most farmers (24%) and FIPAH also assisted a significant share of farmers (18%) in 2012 (Table A5.6).

Coordinators reported that the main strength of these two distribution models was the installed capacity of these partners (Table A5.8). Although they did not report a common weakness across these channels, DICTA's coordinator reported that the main weakness of working with its regional office in Occidente was their limited human and other resources (e.g. vehicles, fuel). Further, Zamorano's coordinator said that the main weakness of working with PRR and FIPAH was that this type of projects allow to complete activities at a much higher rate than would normally happen, which makes sustaining the same rate after the funding is over unrealistic. To make these models more efficient in the future, these informants mentioned that the main constraints that need to be addressed are adding new beneficiary farmers, expanding seed market since some partners have the capacity to supply seed to other regions, and increasing the country's capacity to respond to this type of initiatives.

Sub-coordinators noted different models as the best models to disseminate seed in 2012, depending on the institution/region they worked for. While working with CSBs/rural banks worked best for DICTA's Valle de Lean and Olancho offices because these models are sustainable and include a social component, working with their own extension staff (i.e., direct distribution) worked best for DICTA's Occidente office because coordinators can demand more from their staff and have more control on all activities.

Among the main strengths mentioned by more than one sub-coordinator were that farmers were opened and welcome the idea of the CSBs and the installed capacity of the partners (i.e., CSBs, rural banks, CIALs). As mentioned above, the project coordinators also perceived installed capacity as a strength of the distribution models in 2012. Further, at least one sub-coordinator mentioned three more strengths: that the seed was a complement to their ongoing activities (easily incorporated), that many more farmers were reached thru these partnerships, and that farmers welcome the idea of the CSBs.

Among the major weaknesses pointed out by more than one sub-coordinator were that the Government does not officially recognize participatory-bred (PPB) varieties (distributed thru CIALs) which does not make it possible to disseminate/sell seed in large areas and the limited human and financial resources by all partners involved in the project (including Zamorano and DICTA), which did not allow Zamorano/ DICTA following up more frequently with its partners and the partners not following up with farmers

after the seed was distributed. Limited resources were also considered a weakness by the project coordinators. Further, at least one sub-coordinator mentioned that late seed delivery was a weakness.

More than one sub-coordinator mentioned that the main constraints that need to be addressed to make these seed distribution models more efficient in the future was the need of additional human and financial resources (especially for follow up activities) and the need for better facilities (processing, packaging, storing) if seed volumes increase.

More than one technician/extension worker listed the following strengths as important: good inter-institutional collaboration, higher production obtained by using these varieties, and the good quality of the seed (Table A5.9). Similar to coordinators and/or sub-coordinators, extension workers also mentioned that the installed capacity of the partners, the seed of the BTD project being a complement to their ongoing activities, the partnership with some organizations (i.e., '*organizaciones facilitadoras*') which allowed them to reach/assist more farmers, and that farmers welcome the idea of the CSBs were strengths of the project. Further, at least one technician/extension worker mentioned that reaching beneficiary farmers directly (as opposed to many intermediary partners) and the good reputation of some partners with farmers were strengths of the project.

Among the weaknesses listed by more than one technician/extension worker were that the amount of seed distributed per farmer was not enough and that in some communities farmers did not go to the meetings to receive the seed because they wanted fertilizers too (Table A5.9). Similar to coordinators and/or sub-coordinators, extension workers also mentioned the following weaknesses of the project: that the Government does not officially recognize participatory-bred (PPB) varieties, late seed deliveries, and the limited resources of partners to follow up with farmers. Further, at least one extension worker mentioned that more training and more technical assistance were needed.

More than one CIAL/farmer group indicated the following strengths of the project: that the project allowed farmers to have access to good quality seed and the training received from the project. Further, as coordinators, sub-coordinators and/or extension workers did, CIAL/farmer groups mentioned the good quality of the seed and that the seed contributed to increased production and income as strengths of the project.

A common weakness mentioned by more than one CIAL/farmer group was the need for better follow up after the seed was delivered. Further, as coordinators, sub-coordinators and/or extension workers did, CIAL/farmer groups mentioned the need for more training about seed production, technical assistance to farmers, late seed deliveries, limited human and financial resources, and the Government not officially recognizing PPB varieties as weaknesses of the project.

Finally, seed producers mentioned that two of the main strengths of this project were the good technical assistance they received from DICTA and the secure seed market guaranteed by the contract between them and DICTA. The main weaknesses, as also reported by other informants, were that they received the registered seed late (this seed was used to produce quality-declared seed) and the need for additional training about seed production and processing.

The above results suggest that there may be many models that could work for this type of initiatives, all depending on the specific conditions of where the seed is to be distributed. For example, working with DICTA's regional offices, with NGOs or farmer groups (e.g., CSBs, rural banks, CIALs) worked well in 2012. However, as Table A5.6 suggests, in 2012 more farmers were reached by PRR and DICTA-Occidente (though DICTA-Olancho and FIPAH were very close). These two partners had many characteristics, including good staff, installed capacities, good collaboration with farmers, good relation with project coordinators and other partners, and experience in the region they work on. Although these

partners lacked financial resources, they did the best with their available resources. Making additional financial resources available would be key to the success of this type of initiatives (this was listed as a common weakness and a constraint).

Finally, while there were many common strengths, which included the installed capacity of partners, openness of farmers to these new ideas (i.e., CSBs), directly reaching beneficiary farmers (as opposed to thru many intermediary partners), good quality of the seed, good reputation the partners have with farmers, and partnerships allowing reaching more farmers, there were several important weaknesses that could threaten the success of this (or similar) project. These weaknesses included the need for additional training, technical assistance, follow up visits, and delivering the seed on time. Some of these weaknesses were also common in Guatemala.

Sustainability of BTD models. Coordinators and sub-coordinators were inquired about what incentives would be necessary to guarantee the sustainability of the distribution models implemented by the BTD project after the project finalizes and what local organization/institution could be the link between all partners along the seed supply chain. These informants reported that the main incentives were the need for additional financial resources (especially for transportation and follow up visits), job stability, to provide inputs to newly formed CSBs to motivate them, include local seed producers in the project to exploit their local capabilities/resources, and to make available enough basic seed to satisfy demand. Further, these informants mentioned that the best positioned local institution to link all partners in the seed supply chain were DICTA and Zamorano, but that strengthening alliances with partners and becoming more efficient would be key to the success of this project.

Nicaragua

Unlike Guatemala and Honduras, no key informant interviews were conducted in Nicaragua. Thus, the strengths and weaknesses of the CSB model are analyzed based on the data obtained through the two CSB Surveys.

Strengths and Weaknesses. In principle, the CSB model offers many strengths, including the ability to meet local demand for specific high-quality seed varieties within each community at lower transaction costs. Further, the community benefits by having a local secure source of quality seed with the option to pay at harvest and the CSB members benefit from obtaining seed production knowledge and a new income source as stakeholders in the CSB. However, potential weaknesses include the fact that CSB members may not work well in groups and may lack technical expertise to produce high-quality seed. Depending on the resource and capital availability, they may not be able to meet the community demand for large quantity of seed and diverse types of varieties. In addition, the seed transactions are based on social relationships and trust among community members and there is an element of risk underlying the CSB model—the risk of not recovering the investment of CSB members if beneficiary farmers do not repay the seed. Many of these strengths and weaknesses were observed in Nicaragua.

As seen in Table A5.4, members of the CSBs received training from INTA in how to form a CSB, bean seed production and post-harvest treatment, handling and storage. We cannot imply that CSB members would not obtain this knowledge in the absence of the BTD project, but implementation of the CSB model does provide the opportunity to learn through practice with the guidance of INTA technicians and the CSBs promoter. However, only a small share of CSBs reported receiving training on administrative and financial management of the CSB, which can be considered a weakness. Further, there is also room for improvement in terms of providing training on seed marketing or commercialization. For long-term sustainability, seed marketing and business administrative skills are necessary for the success of the CSB 'business model.' (David, 2004).

The CSBs could play an important role in providing information to both farmers (about new varieties) and to INTA (about farmers' variety preferences). Such two-way information flow is an important strategy to increase demand for new varieties (Maredia et al., 1999). The results suggest that almost one-half of the CSBs reported that farmers wanted different bean varieties than the ones distributed by the project (Table 5.2), suggesting that another weakness of the project was the limited number of varieties offered to farmers.

Although including a label on the seed package could be extremely important to communicate information about the varieties distributed, less than one-half of CSBs reported disseminating seed in packages with labels (Table 5.2), clearly indicating that this could be improved in future years if CSBs continue with this initiative.

Another strength of the CSB model was the high quality of the seed distributed. Overall, the CSBs reported an acceptable germination rate, which is one indicator of seed quality. However, there is room for improvement in other indicators of seed quality, such as the humidity content of the seed and the physical purity rate (Table 5.2).

As in Guatemala and Honduras, there were minor issues with late seed deliveries. As Maredia, Reyes and DeYoung (2014) report, 10% of surveyed farmers reported receiving seed after the date they anticipated planting. The same was reported in the survey of CSBs--90% of beneficiary farmers received the seed prior to the anticipated planting date. Overall, one of the strengths of the project is that the seed was delivered on time for planting. As previously discussed, one reason for being able to provide seed in a timely manner is the proximity of the CSBs to the farmers.

Another weakness of the CSB model in Nicaragua is that CSBs disseminated or lend seed to other farmers at a 56% rate (Table 5.4) instead of the anticipated 67% rate. Although INTA could pressure CSBs to disseminate more seed, it is ultimately the CSB that decides how much seed to designate for other farmers. Additional research is needed to disentangle the possible causes of the low dissemination rate.

Finally, although the repayment of seed (i.e., Repayment Rate 1) discussed in this document is a lower-bound estimate of repayment, given that Maredia, Reyes and DeYoung (2014) demonstrated that repayment rate in Nicaragua was high (95%), this could be considered a strength of the project. As discussed before, seed repayment is extremely important for the sustainability of the CSB model over time and the community members' willingness to pay for seed must be analyzed prior to implementing the CSB model in a community. A delicate balance of providing reasonable payment options and enforcing seed repayment must be found.

Sustainability. INTA has reported that many CSBs will continue producing seed beyond the BTD project's final year. While these CSBs will continue to receive technical support through the INTA regional offices and its technicians, they have reached a level of sustainability anticipated for all CSBs in the project. Over the course of the three years, the CSBs should have amassed a working capital sufficient enough to purchase the inputs and registered seed required to continue CSB operations. The results suggest that this may be the case due to the relatively high repayment rates observed (Maredia, Reyes and DeYoung, 2014). Added to this, INTA made the decision after the second year of the BTD project to discontinue supporting several low preforming CSBs, which may have discontinued their operations (BTD, 2012). Among the CSBs that "survived" Year 1, 80% reported that they would continue in the project's second year (Table 5.2).

Final reports from project coordinators in Nicaragua[5] indicate that only 34 CSBs participated in the BTD project in all three years while 389 CSBs participated during only one of the three years (Table 5.7). However, some CSBs have restructured or changed names and are considered different CSBs in subsequent years. For example, within a particular community in the Centro Norte region, one CSB participated in the BTD project all three years. However, by the project's final year, four additional CSBs began in the same community. The promoters of the four new CSBs had been members of the original CSB and had held office positions such as treasurer and secretary, suggesting that the original CSB split into several CSBs (for unknown reasons). Further, changes within INTA could also affect the decision to continue working with a particular CSB in a region. Thus, the selection of CSBs by INTA regional staff and technicians must be done with care to avoid such a high turnover of CSBs in future initiatives like the BTD project.

Table 5.7. Participation of Community Seed Banks in the BTD Project in Nicaragua, by Region and over time.

Details	Centro Sur (N=105)	Centro Norte (N=95)	Las Segovias (N=136)	Pacífico Norte (N=128)	Pacífico Sur (N=23)	TOTAL (N=487)
Number of CSBS that…						
Participated All Three Years	2	1	2	12	17	34
Participated in Years 1 and 2	12	4	1	5	1	23
Participated in Years 2 and 3	4	4	11	7	3	29
Participated in Years 1 and 3	4	0	3	5	0	12
Participated only in ONE of the three project years	83	86	119	99	2	389

Source: Llano, A. and Pavón, J.F. 2014. Personal communication via e-mail on April 22, 2014.

[5] Llano, A. and Pavón, J.F. 2014. Personal communication via e-mail on April 22, 2014.

6. Summary and lessons learned from the BTD project's seed dissemination models

Next we present a summary of the findings of the study and conclude with lessons learned from the seed models implemented by the BTD project and that could be taken into consideration for future similar interventions.

6.a. Summary

In 2012, seed production was under the responsibility of different partners, depending on the type of seed. For example, Foundation seed was under ICTA's responsibility in Guatemala, Zamorano in Honduras and INTA in Nicaragua. Similarly, ICTA in Guatemala, DICTA in Honduras and INTA in Nicaragua produced Registered seed. In contrast ICTA in Guatemala (thru individual large seed producers), CIALs/farmer groups/NGOs/CSBs/seed multipliers in Honduras and CSBs in Nicaragua were responsible for producing Quality-declared seed. Further, while most of the Quality-declared seed was produced using Registered seed, the partners collaborating with Zamorano used Foundation seed (generally of higher quality than Registered seed) to produce Quality-declared seed.

Quality-declared seed distribution in the second year of the project was done in all three countries thru a network of collaborators that included NGOs, CSBs, CIALs, Government regional offices, among others. While the seed distribution models were similar across years within Honduras and Nicaragua, this model was different for 2012 than 2011 and 2013 in Guatemala. The main reason for this was that in 2012, due to political changes in Guatemala, ICTA needed to find alternate partners to distribute the Quality-declared seed to beneficiary farmers.

The background of the project's collaborators in Guatemala and Honduras was diverse. In 2012, having non-contractual arrangements with partners/collaborators was more common than having contractual arrangements both in Guatemala and Honduras. While non-contractual arrangements were efficient in both countries, contractual arrangements were more efficient in Honduras than in Guatemala. Further, having contractual arrangements was more common in Honduras than in Guatemala.

Among the main steps needed to implement the BTD project in Guatemala and Honduras were establishing alliances with partners, identifying beneficiary communities and beneficiary farmers within these communities and coordinating training for partners' staff and seed producers. Further, in Guatemala, careful planning of activities was required. Also, in Honduras, signing a commitment letter between Zamorano and DICTA, producing enough basic and foundation seed for all partners in Honduras and other countries, supporting some partners, and hiring part-time staff for the project were necessary.

In its three years, the BTD project has distributed a total of 177 MT of quality-declared bean seed and directly benefited a total of 33,342 farmers in Guatemala and 137 MT of quality-declared bean seed and directly benefited a total of 26,000 farmers in Honduras and 168 MT of quality-declared bean seed and directly benefited a total of 16,065 farmers in Nicaragua. Although the number of varieties that were distributed in all three countries increased over time, the amount of seed distributed per farmer decreased over time. Contrary to Guatemala and Nicaragua where only conventionally-bred varieties were distributed to farmers, in Honduras, the varieties distributed included many conventionally-bred varieties and a large number of participatory-bred varieties.

To reduce farmers' dependency on receiving or expecting free seed from the project, beneficiary farmers were told they needed to pay back the seed they received from the project. The amount they needed to pay back varied by country. In Guatemala, the most common payment arrangement was for farmers to pay one pound of grain for each pound of seed they received (lb. x lb.). In Honduras, farmers who received varieties from institutions distributing conventionally-bred varieties had three options: pay one pound of grain for each pound of seed received, no payment but needed to give part of the grain harvested to other

farmers, or other type of payment (combination of payment types). In contrast, farmers who received participatory-bred varieties agreed to pay twice the amount of seed received. In Nicaragua, as in Guatemala, farmers could pay different amounts of grain for the seed received. In general, the "price" of the seed in all three countries was the same or twice the price of grain. To compare, the 2014 price of certified bean seed for Honduras was slightly more than twice the average (2010-2014) price of grain and in Guatemala it was slightly more than eight times the average (2010-2014) price of grain (Table A6.1). In contrast, the 2009 certified bean seed price for Nicaragua was slightly more than twice the average (2010-2014) price of grain (although there is no certified seed price available for 2014 for this country, in general this price is nearly twice the price of grain) (Table A6.1). In general, the price of certified seed does not fluctuate much over time. Given the high difference between the price of certified seed and grain, the project clearly provided affordable seed to farmers in Guatemala (up to twice the price of grain). In contrast, in Honduras and Nicaragua, price may not be the deciding factor when farmers are deciding whether to purchase certified seed since both the price of certified seed and quality-declared/apta seed (distributed by the project) was near twice the price of grain. Thus, other factors (e.g., timely availability, accessibility, quality) may explain why farmers do not purchase certified seed from the government. Given that we cannot answer this question empirically due to data limitations, additional research in this area is necessary.

Although most respondents in Guatemala reported that farmers agreed to the most common type of payment arrangement, roughly only one out of every three farmers paid back the seed they received in 2012. In contrast, in Honduras, between 57% and 71% of beneficiary farmers receiving conventionally-bred varieties and 82% of beneficiary farmers receiving participatory-bred varieties have paid back the seed they received. In Nicaragua, 53% of beneficiary farmers repaid twice the amount of seed they were given.

While setting a payment arrangement before distributing the seed is a good practice, recovering the investments made to produce the quality-declared seed (so the models are sustainable) depends on farmers actually repaying the seed; that is, honoring the payment agreement, which is difficult to enforce. The limited human and financial resources might have been a factor for partners not being able to follow up with farmers to persuade them honor this payment arrangement. Low payment rates could threaten the sustainability of seed systems.

In general, farmers in all three countries were satisfied with the quality of the seed they received. However, while key informants in Guatemala reported that farmers were satisfied with the varieties they received, coordinators and sub-coordinators in Honduras reported that some beneficiary farmers were not satisfied with the varieties they received (although no extension worker reported this in Honduras). Similarly, the survey data of CSBs in Nicaragua show that farmers wanted more varieties than the ones offered by the project.

Although many informants in Guatemala and Honduras reported that the amount of seed distributed per farmer in 2012 was adequate (though some informants in Honduras reported that farmers wanted more seed), in Nicaragua, CSBs could not satisfy the demand for seed, suggesting that farmers wanted more seed. While most seed was distributed on time for planting, there were some issues with late seed deliveries across all three countries.

Across countries, there were many strengths and weaknesses of the models implemented by the BTD project to distribute seed to beneficiary farmers. For example, in Guatemala, coordinators and sub-coordinators considered the partnership with SNEA in 2011 and with regional government offices (ICTA, MAGA) and SOSEP in 2012 as some of the best seed distribution models. The major strengths of these models were the quality of the seed produced, installed capacity of the partners and the seed reaching beneficiary farmers directly (mostly in Guatemala) and efficiently. However, weaknesses included the

late delivery of the seed and the need to provide, in addition to seed, technical assistance to farmers (complete technical package).

In Honduras, although coordinators and sub-coordinators considered the partnership with regional offices and NGOs as some of the best seed distribution models in 2012, the results suggest that there may be many models that could work for this type of initiatives, all depending on the specific conditions of where the seed is to be distributed. Some of the most successful partnerships included partners with capable staff, installed capacities, good collaboration with farmers, good relation with project coordinators and other partners, and experience in the region they work on. Weaknesses included the need for additional human and financial resources, training, technical assistance, follow up visits, the Government to officially recognize participatory-bred varieties, and delivering the seed on time.

In Nicaragua, some of the many strengths observed under the CSB model included producing high-quality seed within each community, low transaction costs, having the option for farmers to access seed with the option to pay at harvest, high repayment rates, CSB members receiving training in many topics and new income source (from seed sales). However, some weaknesses included CSB members not working well in groups, not meeting local demand for seed (due to many factors, including distributing less seed than anticipated despite having enough stocks to distribute more seed) and/or supplying a limited number of varieties (farmers wanted other varieties), the need for additional training (particularly on seed marketing or commercialization) and late seed deliveries.

Thus, some of the common strengths across countries were the high quality of the seed that was produced and distributed and the installed capacities of partners. Some common weaknesses included the limited training of partners, limited technical assistance to farmers and in a few cases, late seed delivery. Although the latter was true, most farmers in all countries received the seed on time.

To make these models more efficient in the future, key informants in Guatemala reported that major constraints that need to be addressed included the need to better identify potential beneficiary farmers, additional human and financial resources, and overcoming political instability. Similarly, in Honduras, key informants reported that there is a need to add new beneficiary farmers, expand seed markets, increase the country's capacity to respond to this type of initiatives, add human and financial resources, and use better facilities. Thus, in these countries there are constraints in both the supply and demand sides of the seed value chain that should be taken into consideration for future similar initiatives.

Key informants in Guatemala reported that among the incentives needed to make these models sustainable are the need for the government to provide more financial resources for the public partners, the need to better train extension workers, to guarantee a constant flow of technologies to farmers, and job stability of the staff. Similarly, in Honduras, informants reported the need for additional financial resources, job stability, to provide inputs to newly formed CSBs to motivate them, include local seed producers in the project to exploit their local capabilities/resources, and to make available enough basic seed to satisfy demand.

Finally, in all countries is clear that partnering with other institutions or strengthening alliances with partners is necessary to become more efficient and reach as many farmers as possible.

6.b. Lessons learned

The results suggest that, for this type of projects to be successful, selecting the right partners along the supply chain and good coordination is key. It is extremely important to identify good seed producers and to constantly supervise them to guarantee the quality of the seed. Also, producing and distributing enough

bean varieties adapted to the regions of interest is key so these varieties perform well and farmers could become permanent adopters of IVs. Further, it is necessary to have a clear idea of the amount of quality-declared seed that will be distributed to farmers since this has implications for the breeding programs who will be supplying the foundation seed (which may need to be produced to have sufficient stocks for the project) that will be used to produce the registered and then the quality-declared seed that will eventually be distributed to farmers. Careful planning and coordination of seed production, packaging and delivery to partners is fundamental for them to have the seed ready for distribution when and where is needed.

While the production of quality-declared seed can be done in different ways, the ideal partner to assist in the distribution of seed must have installed capacity in the regions where the seed is to be distributed, good collaboration with farmers, good logistics, experienced staff, and resources available so this process is efficient and could be easily incorporated as a marginal activity to the portfolio of activities already carried out by this partner. Further, a good/solid relation among partners is key for the success of this and any project.

Since most farmers are used to recycle the grain they harvest in one season as seed in the following season, it is important to educate farmers about the differences between sowing grain vs. seed and to help them differentiate the varieties they are given. For example, some informants reported that farmers generally give the same management to the bean crop regardless of whether they sow grain or seed (e.g., never fertilize, do weeding or apply pesticides). Although there may be many reasons for which a farmer, say, do not apply purchased inputs, with additional technical assistance perhaps they can learn to invest some of the available resources (e.g., family labor) to the bean crop so the yield potential of the seed of the improved varieties they received could be expressed.

Further, to help farmers differentiate the varieties they are given, these initiatives need to give the seed in a sealed package with a label that should include relevant information like the name of the variety. This should help the farmer remember (at least) the name of the variety he/she grows and when asked, use the proper name instead of naming the variety differently. Also, for individuals/groups producing and distributing seed within a community, training on seed production techniques and marketing practices are necessary.

Although most farmers received seed in their communities and/or on time, a small share of farmers needed to travel to a place outside its community to obtain the seed and/or received the seed late for planting. Late seed deliveries should be minimized since these may threaten the success of this type of initiatives. However, given the limited amount of time between when the seed is harvested and when it needs to be distributed, delivering the seed late for planting in some (especially distant) regions may be a fact. Project implementers need to attempt to foresee this and plan accordingly to avoid late seed deliveries as much as possible. Further, as one might expect, late seed deliveries were more common in models where the seed was produced in one region, transported to another region for processing and distributed in another region; that is, in models without local (i.e., within the community) seed production. Thus, finding ways to produce the seed more closely to where beneficiary farmers will receive it should help to avoid late seed deliveries.

Finally, if this and similar publicly funded projects are to be sustainable, it is important to supply quality-declared seed at an affordable price and to determine the best way to recover the cost of producing the quality-declared seed, especially among local seed producers (that in most cases also distribute the seed, like CSBs, CIALs, etc.) that have no secured market (e.g., are not contracted by a project to produce seed for that particular project). Although setting up a payment arrangement can be easily thought and decided among partners, the challenge lies in the difficulty of enforcing payment arrangements. If beneficiary farmers do not pay back the seed they receive, it will be difficult for the individuals or groups supplying seed to have enough capital to continue producing seed over time. Although many factors (e.g., price,

weather, expected production) could affect a beneficiary farmer's decision to honor the payment arrangement, the results suggest that models that include local partners within the community to produce and distribute the seed (e.g., CSBs, CIALs, rural banks) have a better chance to recover these investments. The reasons for this could be several, including the borrowers' willingness to honor the payment arrangement because of his/her desire to maintain a good reputation within the community, and such local knowledge on borrowers' reputation, in turn influencing the seed lender's confidence in 'selling' the seed based on trust and mutual agreement based on a non-cash repayment type.

Annexes

annels used by breeding programs to make available seed of improved varieties (IVs) to farmers prior to their perceived strengths and weaknesses.

Country		
Guatemala	**Honduras**	
Government programs (from MAGA)	For conventionally-bred varieties: **Government program (*Bono Tecnológico Productivo/Bono Solidario*)** and any seed initiative by different organizations (e.g., FAO, NGOs)	For participatory-bred varieties, thru the CIALs and Seed Funds
1) Allow farmers to know different varieties	1) **Good logistics (established program)** 2) **Alternative way for farmers to access seed of IVs** 3) **Farmers receive varieties with higher genetic potential** 4) **Has contributed to price stability since production has not decreased** 5) One of the first large-scale dissemination methods (motivated in part by post-MITCH seed distribution project) 6) Farmers also received fertilizer as a complement 7) Could be an efficient channel when coordination is good and with transparency 8) Bean seed is distributed in bean-producing areas	1) Seed disseminated by CIALs so low distribution cost for NGOs 2) Members were trained on how to produce seed
1) Seed distributed based on political interests 2) ICTA became a seed producer for MAGA 3) Seed generally produced with large farmers so small farmers do not benefit from producing seed 4) Free seed creates dependency (training on how to preserve the quality of the seed may reduce this) 5) No technical assistance, only seed	1) **Seed distributed based on political interests** 2) **The quality/genetic quality of the seed is not guaranteed** 3) **Some varieties are not adapted to environments where distributed** 4) Paternalism: farmers always expect both seed and fertilizers from the Government program 5) Seed in the Atlántida and northern Yoro Departments sometimes arrives late for planting 6) Incomplete efforts because seed provider and bean producers are not integrated (so demand is unknown)	1) Not a permanent source of seed for these varieties (seed is not always available)

Interviews (2013)
than one informant reporting the same information.

Table A5.1. General characteristics of Bean Technology Dissemination (BTD) project coordinat and sub-coordinators in 2012.

Characteristics	Coordinators & Sub-coordinators	
	Guatemala (N= 8)	Honduras (N=10)
Prior to BTD, did you have experience on seed production, management and distribution? (% yes)	22	70
If YES, average years of experience	7.3	7.2
Share (%) of time devoted to the BTD project	35	23
Did you provide training to your collaborators? (% yes)	75	70
Did your institution have contractual arrangements with your collaborators? (% yes)	25	40
If YES, were these arrangements efficient? (% yes)	50	100
If not efficient, why not (main reason)?	SNEA's extension agents were fired in 2012	
Did your institution have non-contractual arrangements with your collaborators? (% yes)	86	90
If YES, were these arrangements efficient? (% yes)	67	78
If not efficient, why not (main reason)?	Need to better train extension agents to empower CSB concept and wanted more techical assistance from ICTA	Benefits per member v too small (no incentive also seed was not deliv on time
Did your institution monitored seed production & distribution? (% yes)	100	100

Sources: Key Informant Interviews (2013)

Table A5.2. General characteristics of seed producers and CIALs/farmer groups collaborating in the Bean Technology Dissemination (BTD) project in Year 2.

General characteristics	Guatemala	Honduras	
	Seed producers (N=2)	Seed producers (N=7)	CIALs/Farmer groups (N=8)
Prior to BTD, did you produce bean seed? (% yes)	0	43	25
If YES, average years producing bean seed		3	3
Do you have a seed processing plant to clean and pack seed? (% yes)	0	0	0
Seed storage method (%):			
In "silos"	0	33	50
In sacks, over a wood pallet	50	0	12.5
In sacks, directly on the floor	0	17	12.5
In a warehouse	0	0	0
Other storage method	50	50	25
Year when you started to produce seed for the project (%):			
In 2011	50	43	37.5
In 2012	50	43	62.5
In 2013	0	14	n.a.
Additionally to the BTD project, did you produce seed for other projects/personal purposes? (% yes)	0	43	25
If YES, what was the share of seed produced for BTD?		72	<50
Did you receive training about seed production from the project? (% yes)	50	71	75
Did this group distribute seed of the project in 2012-13? (% yes)	n.c.	n.c.	75

Sources: BTD Project's Key Informant Interviews (2013)
n.c. = data not collected; n.a. = not applicable.

Table A5.3. General characteristics of technicians/extension workers collaborating in the Bean Technology Dissemination (BTD) project in Year 2.

General characteristics of technicians/extension workers	Guatemala (N=15)	Honduras (N=11)
Average age*	33.8	43.8
Gender (% male)*	71	90
Average years working in the region	13.2	7.2
Average years working for your institution	5.2	6.0
Did you distribute seed of the project in 2012-13? (% yes)	100	100

Sources: BTD Project's Key Informant Interviews (2013)

* These variables could not be collected for every respondent since some interviews involved more than one person. Thus, sample size is smaller than listed.

Table A5.4. General characteristics of sampled community seed banks (CSBs) collaborating in the Bean Technology Dissemination (BTD) project in Nicaragua in Year 1.

Details	Seed producers in*		
	PN, PS, LS and CN (N=113)	CS (N=40)	National
Community Seed Bank Formation			
Year when the CSB was formed/Board of Directors was elected (% yes):			
In or before 2009	4	0	3
In 2010	24	0	18
In 2011	66	25	55
Did not answer	5	75	23
Average number of CSB Founding Members	13	9	13
Training received from the BTD project:			
Did at least one member of the CSB receive training from the BTD project in… (% yes):			
How to form/constitute a CSB?	94	31	78
Seed production?	95	97	95
Post-harvest seed processing?	76	89	79
Administrative and financial management of CSB?	5	16	8
Commercialization/marketing of seed?	19	35	23

Sources: BTD Project's Survey of CSBs

* Country regions: PN = Pacífico Norte; PS = Pacífico Sur; LS = Las Segovias; CN = Centro Norte; CS = Centro Sur.

Table A5.5. General characteristics of sampled community seed bank (CSB) members collaborating in the Bean Technology Dissemination (BTD) project in Nicaragua in Year 1.

Details	CSB Members (N=1,087)
General characteristics	
Age (% of respondents in each category):	
Less than 18	1
18 to 30	18
31 to 50	52
51 to 65	24
Older than 65	5
Gender (% female)	21
Education (% of respondents in each category):	
No formal	10
Grade 1-5	53
Completed Grade 6	24
Completed Grade 9	6
Completed Grade 12	3
Studied beyond Grade 12	4
Participation of family members in CSB (% yes)	
Does this individual have an immediate relative* in the CSB?	42
Does this individual have a close relative** in the CSB?	27

Sources: BTD Project's Survey of CSBs

*Immediate relatives include siblings, parents or children.

**Close relatives include uncle, aunt, grandparent, nephew, neice or cousin.

Table A5.6. Share of beneficiaries receiving seed from each partner institution of the Bean Technology Dissemination (BTD) Project in Year 2.

Institution Name	Share (%) of beneficiaries in 2012
Guatemala	
MAGA-Extension	39
SOSEP	17
FONTIERRAS	15
Farmer Organizations	9.1
Municipalities	8.0
Groups connected by Politician Natan Rodas	5.3
Others*	7.1
Total Guatemala	**100**
Honduras	
PRR	24
DICTA-Occidente	23
DICTA-Olancho	22
FIPAH	18
DICTA-Valle de Lean	8.3
EAP	3.5
Individual	0.5
INA	0.3
ACCESO	0.3
ATRIDES	0.2
Total Honduras	**100**
Nicaragua	
Community Seed Banks (CSBs)	**100**

Source: BTD project final report and databases.

*A total of 876 beneficiaries in 'others' were from the Department of Petén but BTD dataset not detail which institution distributed the seed. Since MAGA was the only partner distributing seed in Petén, these were accounted under 'MAGA-Extension' and not under 'others.' Beneficiaries accounted in the 'others' category came from the Departments of Retalhuleu (28%), San Marcos (18%), Alta Verapaz (11%), Chimaltenango & Suchitepequez (7% each), Baja Verapaz & Quiche (6% each), Huehuetenango (3%), and Quetzaltenango & Solola (<1% altogether).

: Key informants' perceived BTD project strengths, weaknesses and constraints, Year 2.

l dissemination model on why	**Strengths**	**Weaknesses**	**Constraints**
el for ICTA: MAGA A Huehuetenango +	1) Change in Government's mentality to support these projects	1) These seed dissemination models are not a "policy" yet	1) SNEA network not institutionalized
	2) ICTA currently implementing this model with other crops	2) SNEA staff also needs to train farmers on bean production technologies	2) Private sector does not provide extension services to complement these efforts
xcellent staff	*3) Facilities are available to pool seed and distribute it (established capacity)*	*3) Seed not always available in a timely manner where and when it is needed*	
el for ICTA: SNEA SOSEP (2012)	**1) "Promotores"/extension network already established**	**1) Political instability (no job security-"experienced" staff lost in 2012)** 2) Sometimes staff devotes too much time to politics and not to do the field work	**1) Political instability 2) Need more human resources committed to this type of work**
sitive attitude of staff work			
el for MAGA-Peten: ES	**1) "Promotores"/extension network already established** 2) "Promotores" have a list of priority communities they support	**1) Not enough financial resources to distribute seed**	**1) Need more financial and human resources**
eached many small ers			
el for MAGA-nango: SNEA	1) Good staff 2) Farmers got closer to extension staff 3) Farmers received "registered" seed 4) Farmers welcomed the seed	**1) Not enough financial resources to distribute seed (staff needed to use own vehicles)**	1) Need to brake cultural barriers so farmers work with extension staff 2) Need more training for extension staff on CSB concept **3) Need more financial resources (to buy fuel)**
each farmers directly			
el for SOSEP: Directly s (not thru lities)	***1) Seed reached beneficiary farmers directly*** 2) By visiting farmers, extension staff gets an idea of where beans will be planted	1) Farmers may get used to "easy" seed (since was delivered to them)	**1) Need more financial and human resources**
seed reach farmers and de direct technical e			
ner respondends with distribution model irect distribution)…	**1) *Established capacity*/good logistics to collect and distribute seed** 2) Easy to integrate other activities since communication with farmers is constant ***3) Seed reached beneficiary farmers directly*** 4) Farmer groups selected their own beneficiaries	**1) Political instability (no job security-"experienced" staff lost in 2012)** 2) Silos were too big for some farmers 3) Needed more seed to reach more farmers *4) Need to provide more direct technical assistance to farmers about seed management 5) Delays in delivering the seed*	**1) Need to reduce the number of beneficiaries/focus on fewer regions** *2) Need to better identify potential beneficiaries* (some may grow beans but not in good conditions) **3) Political instability** 4) Need to measure impact of these interventions

Table A5.7 (continued)

Key informant type	Best seed dissemination model and reason why	Strengths	Weaknesses	Constraints
Seed producers (N=2)	Not applicable (strengths and weaknesses are about their seed production)	1) Contract allowed to get cash advance 2) ICTA has good reputation 3) ICTA is reaching farmers 4) ICTA has capable staff with will to do the job 5) ICTA detailed how seed needed to be produced	1) Old irrigation system	Not applicable
Technicians/ Extension workers (N=15)	Not applicable (strengths and weaknesses are about their seed dissemination efforts)	**1) COCODES are active organizations and know farmers very well and officers are well connected 2) With BTD, they supported communities they regularly visit for their work (seed complemented their technical assistance work; follow up possible) 3) Farmers trust/committed with extension staff** 4) Since farmers need to re-pay with grain, there is no "paternalismo" **5) Good organization and interinstitutional support** *6) Seed was delivered quick and efficiently and close to beneficiaries (no cost to them)* **7) Good quality of the seed 8) Farmers had access to seed** (as opposed to using grain) 9) Farmers did not spend on seed	1) In some communities, farmers only attended seed-distribution meetings and never attended training sessions **2) Need better planning/organization (e.g., record keeping)** *3) Need to better identify beneficiary farmers* 4) ICTA needs to validate "package" in different regions because farmers manage IVs the same way as traditional varieties **5) Farmers want a complete (fertilizer, pesticides, technical assistance, storage) technical package** 6) In some regions, farmers need the seed when they plant (e.g., January) 7) Need to plant demonstrative fields to convince farmers ***8) Late delivery (from government and local leaders)*** **9) MAGA should deliver seed in the communities since the "Promotor" does not have resources to transport seed** 10) Some farmers did not agree to repay the seed ***11) Farmers do not invest in the bean crop (seed quality is not maintained--need training)*** 12) Need better follow up (from ICTA to collaborators and from collaborators to farmers) 13) Lack of human resources (stretched thin) 14) Need to promote positive stories (videos, printouts) to convince other farmers to use IVs	Not applicable

Sources: BTD Project's Key Informant Interviews (2013)
Note: Bold denotes more than one informant reporting the same information within the same informant type. Italics denote more than one informant reporting the same (or very similar) information across informant types.

Table A5.8. Honduras: Coordinators and sub-coordinators' perceived BTD project strengths, weaknesses and constraints, Year 2.

Key informant type	Best seed dissemination model and why	Strengths	Weaknesses	Constraints
Coordinators (N=2)	Best model for DICTA: Models in "Occidente" region Why?: Farmers value assistance better since they have seldom received assistance before	1) Beneficiary farmers are located in a relatively small area and many work in groups **2) Human resources available *(installed capacity)***	1) *Limited human and other resources (vehicles, fuel)*	1) Need to explore assisting new farmer groups 2) Limited market for the seed that is produced in this region (have potential to supply seed to other regions)
	Best model EAP: with PRR and FIPAH Why?: They are already organized and there is good relation between EAP, the NGOs and farmers	**1) *Capacity already installed*** (human resources, knowledge, experience) so needed investment is low 2) All "players" are working in the same area and have the same interests (capacities are strengthened)	1) Financial support from the project allows to start activities at an unrealistically higher rate than would normally happen and this cannot be sustained after the project ends	1) Country's capacity to react to these type of initiatives is minimal: who will produce Basic seed if EAP cannot do it anymore? DICTA needs to increase its capacity to satisfy demand
Sub-coordinators (N=8)	Best model DICTA-Valle de Lean & Olancho: with CSBs/rural banks Why?: is sustainable and include a social component	1) CSBs can become a seed business, which is an incentive to farmers **2) *CSB idea was welcomed*/farmers committed** 3) Farmers get empowered by these type of projects *4) Can reach more farmers* 5) No "paternalismo"	**1) *Limited human and financial resources to follow up after seed is delivered*** 2) Not a clear guideline that explains the type of data the collaborators need to collect 3) Some seed producers do not have enough knowledge about seed production (even trained ones)	**1) Need more financial resources** for the regional offices/NGOs so they can follow up 2) Provide farmers with Basic seed and not "commercial" seed 3) Farmer groups need to be better consolidated/organized 4) Project implementers need to be more flexible on conditions set to receive seed (DICTA was not flexible)
	Best model DICTA-Occidente: with own technicians Why?: Because can demand more from them and have more control on activities done	1) Technicians are originals from the regions where they work 2) Technicians respond well to hierarchical organization 3) DICTA manages several projects, which makes *easier to complement activities* and avoid duplicity of efforts ***(installed capacity)***	**1) *Limited human resources (hence limited technical assistance)***	1) Need to produce the seed in March/April to deliver for Postrera planting (the most important production season)

	For all other respondents with only one distribution model…	1) ECAs members receive constant training and are able to produce more beans 2) ECAs members can invest their limited resources in other inputs since the good-quality seed is provided at a good price **3) *Capacities already installed* (e.g., Rural Banks, CIALs, NGOs)** 4) Some rural banks have legal status 5) Project provided needed resources to massively disseminate already identified IVs (by CIALs) 6) Seed available and accessible all year round because CIALs' local seed banks 7) Good quality of the seed distributed	1) ECAs do not have seed banks so they need to receive seed every year 2) ECAS have no common plots to multiply seed (farmers have a culture of individualism) 3) If many rural banks are involved, a good leader is key *4) Seed was delivered late* ***5) PPB varieties are not "officially" released* (not formal recognition by the Gov't). so the seed produced cannot be widely sold** 6) CIALs working with PRR could not satisfy demand for quality-seed since demand for seed is unknown ***7) Project managers have limited human resources to follow up with collaborators*** (e.g., visits, supervision)	**1) If seed volume increases, a processing, packaging and storing facilities will become necessary** 2) Need to give farmers a printout/manual on how to use the seed to distribute along with the seed 3) Availability of Basic seed is limited in Zamorano (but understand limitations) so demand for Basic seed sometimes is not satisfied **4) Need more financial resources** 5) Need to have a better strategy to commercialize seed 6) Need more human resources

Sources: BTD Project's Key Informant Interviews (2013)

Note: Bold denotes more than one informant reporting the same information within the same informant type. Italics denote more than one informant reporting the same (or very similar) information across informant types (listed in Tables 4.4 and 4.5).

Table A5.9. Honduras: Seed producers, technicians/extension workers and CIAL/farmer groups' perceived BTD project strengths and weaknesses, Year 2.

Key informant type	Strengths	Weaknesses
Seed producers (N=7)	1) Beneficiaries are organized in groups and have capacity to store seed and sell when price is good *(installed capacity)* 2) This type of project foster collaboration between government and farmer groups 3) Income generated to seed producers 4) UNA students and faculty gained experience with the project 5) Seed production & processing provides work for others, not only seed producers 6) Seed is produced locally **7) Good technical assistance provided by DICTA to seed producers 8) Contract guarantees that the seed will be purchased by DICTA**	1) Some rural banks have no legal status 2) No common plot (that belongs to the group) to produce seed 3) In Atlantida Department, seed was produced in the wrong season (planted in June when is better in October or January) 4) No infrastructure (for seed processing & storage) *5) Need training about seed production & processing (currently use own criteria)* 6) Need better drip irrigation system to produce seed 7) Some seed producers were too far away and had no conditions to produce seed 8) Payment for seed produced sometimes is delayed 9) Need better seed price since production costs are high *10) Sometimes, seed used to produce quality-declared seed was delivered late to seed producers*
Technicians / Extension workers (N=11)	*1) CSB idea was welcomed in Atlantida* 2) Seed reached beneficiary farmers directly 3) Seed distribution used a participatory methodology ***4) Seed of IVs complemented other activities (by same or other projects)*** ***5) Installed capacities*** ***6) Varieties distributed allowed higher production*** 7) Technicians know farmers' problematic **8) Good interinstitutional collaboration 9) Collaboration with "Organizaciones Facilitadoras" allows *reaching more farmers*/area** *10) Quality of the seed was good* 11) Farmers trust organizations due to ongoing collaboration	***1) No resources to follow up* (visits)** *2) Need more training so farmers get more interested in the project* 3) Need more time to deliver seed (too tight) *4) Need more technical assistance to farmers* **5) Amount of seed distributed was not enough** ***6) Seed was received (from project implementers) and distributed (to farmers) late*** **7) In some communities, farmers did not go to seed distribution place because seed was not accompanied by fertilizers (want complete package)** 8) In some areas, the variety distributed did not have a demand 9) DICTA has no control over work of "Organizaciones Facilitadoras"
CIALS and other groups producing / distributing seed (N=8)	**1) Project asssited them with seed** 2) New IVs became known in the communities *3) Quality of the seed was good* **4) Farmers gained access to good-quality seed 5) Training received** ***6) Seed helped to increase production and income*** 7) Learned knowledge is disseminated 8) Received loan to purchase land	*1) No training about seed production was provided 2) Seed was delivered late from DICTA* 3) DICTA did not buy extra seed outside the contract ***4) Need better follow up*** (e.g., to supervise quality of re-paid seed, training) 5) Payment of 2x1 is too high 6) Seed market is uncertain 7) No ownership of fields for seed production (need to rent) *8) Limited human resources 9) Need more technical assistance 10) PPB varieties are not "officially" released* 11) Need financing to start a seed production enterprise 12) "Repeated" beneficiaries are not reported in documents submitted to project administrators

Sources: BTD Project's Key Informant Interviews (2013)

Note: Bold denotes more than one informant reporting the same information within the same informant type. Italics denote more than one informant reporting the same (or very similar) information across informant types (listed in Tables 4.4 and 4.5).

Table A6.1. Average annual bean prices for Guatemala (black beans) and Honduras and Nicaragua (red beans).

Year	Guatemala	Honduras	Nicaragua
*Wholesale grain price ($/qq)**			
2010	46	51	49
2011	47	70	56
2012	49	40	37
2013	42	33	30
2014	39	52	49
Mean (2010-2014)	45	49	44
Certified seed price ($/qq)			
2009**	119	100	80
2014***	363	105	n.a.
Percent increase of certified seed over grain			
2009	231	232	213
2014	814	213	n.a.

NOTES:

n.a. = not available

*Source: Servicio de Informacion Agroalimentaria, Direccion de Mercadeo y Agroindustria, CNP (2014) (2014 only includes January-May prices).

**Source: Key Informant Interviews (2010).

***Source: Luis Flores (2014) (personal communication via e-mail on May 10, 2014).

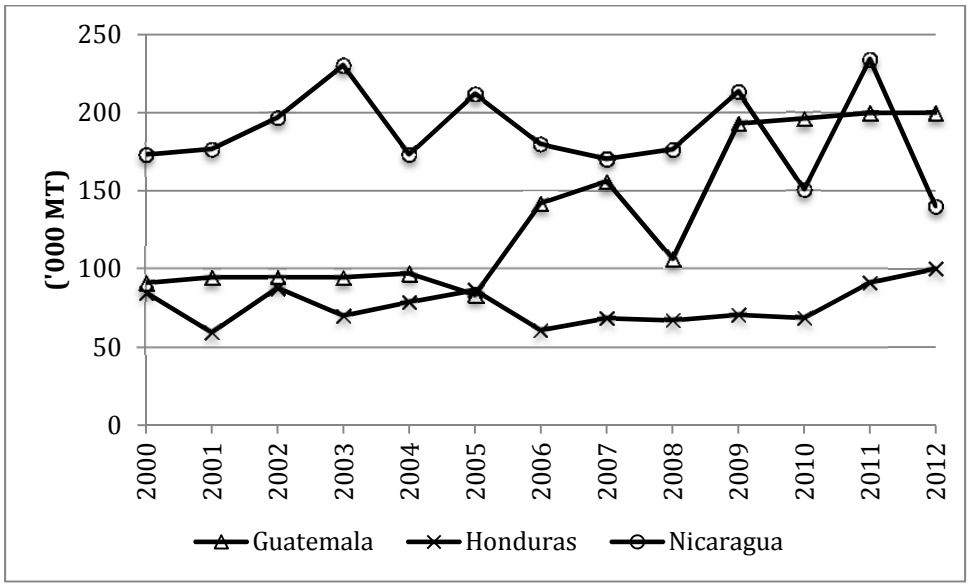


Figure A4.1a. Bean production ('000 MT) in Guatemala (black beans), Honduras (red beans) and Nicaragua (red beans) between 2000-2012. Source of data: FAOSTAT 2014.

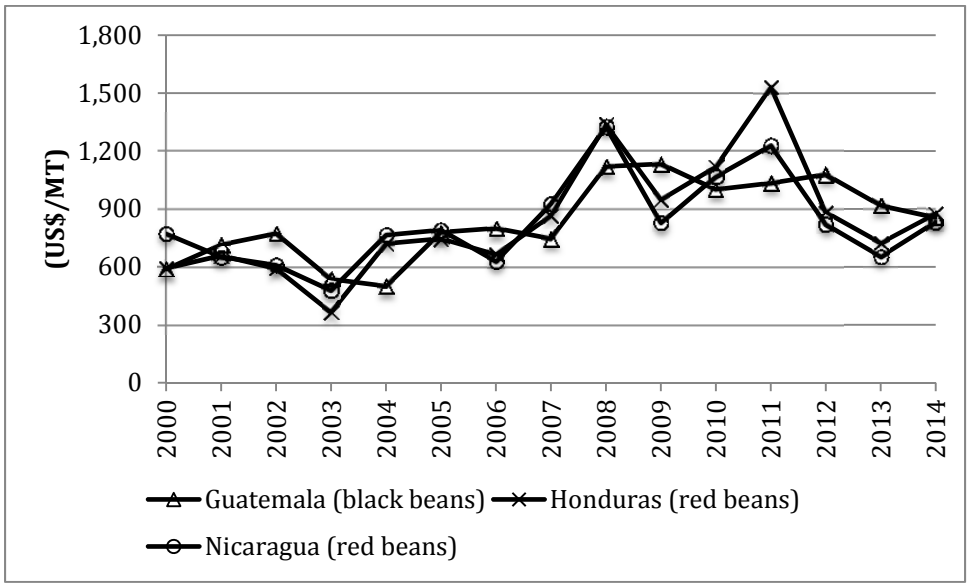


Figure A4.1b. Average annual bean wholesale price (US$/MT) in Guatemala (black beans), Honduras (red beans) and Nicaragua (red beans) between 2000-2014 (January and February only for 2014). Source of data: CNP 2014.

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