IFAD
Investing in rural people

IMPACT ASSESSMENT PLAN

Republic of Rwanda

Project for Rural Income Through Exports (PRICE)

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Introduction

Addressing poverty in rural areas is of paramount importance to reach the Sustainable Development Goals. Yet, there is still need for more rigorous impact assessments that inform policy makers and development practitioners about the most effective interventions to reduce rural poverty (Winters et al. 2010). As an international financial institution focusing on rural development and a specialized United Nations agency focusing on investing in rural people, IFAD addresses this knowledge gap by commissioning the IFAD10 Impact Assessment Agenda (IFAD10 IAA) which aims to provide lessons for better rural poverty reduction programmes and aims to measure the impact of IFAD-supported programmes on enhancing rural people's economic mobility, increased agricultural productive capacity, improved market access and increased resilience. In this context, the Rural Income through Exports (PRICE) project in Rwanda was selected as an ex post impact assessment as part of IFAD10 IAA. PRICE aims to secure sustainable increased income to smallholder farmers through greater production of selected crops and improved access of farmers and farmers' cooperatives to domestic and international markets.

PRICE was approved in 2011 for a total amount of US$ 56 million, of which IFAD committed to finance US$ 37.4 million. Most recently, IFAD approved a top-up of US$ 10.3 million to fill the financing gap of an unidentified co-financier. The project will be completed by the end of 2018 and is expected to reach approximately 118,500 households and 160 cooperatives. PRICE builds on the completed Smallholder Cash and Export Crops Development Project (PDCRE), which was IFAD's first intervention in the sector of export crops in Rwanda between 2003 and 2011, and is in line with Rwanda's Economic Development and Poverty Reduction Strategy 2 (EDPRS2). One important objective of EDPRS2 is to reduce rural poverty in Rwanda from 44.9 percent to below 30 percent by 2018 through increased agriculture productivity which engages the majority of the population (Rwanda's Ministry of Finance and Economic Planning 2013).

PRICE covers five components, namely coffee development, tea development, silk development (sericulture), horticulture, and financial services. After a careful assessment of the implementation progress to-date, it was determined that neither the tea nor the sericulture components are ready for an impact assessment to be conducted in 2017. The plantation of tea is still in its early stages, with sizeable yields to be expected not earlier than in 2018[1]; sericulture represents a very slow portion of PRICE activities and has suffered, until recently, from a very low take-up.

The planned impact assessment will thus focus on coffee development, horticulture development and financial services. Together, they represent 55% of the planned total project cost, and have already reached more than 94,938 households and 174 cooperatives (IFAD 2016c). Selecting coffee and horticulture also represents a compelling comparison between cash and food crop promotion and their respective capacity to increase income in this context. In addition, according to EDPRS2, coffee is one of the prioritised sectors that is expected to further stimulate exports growth. The rest of this impact

[1] A recent study indicates that the net income of tea farmers in the PRICE project was negative (IFAD 2016b). As tea cultivation takes up to seven years until the maximum yield and quality is reached, it is expected that PRICE-supported tea farmers would need to wait at least one or two years until their income from tea will exceed related expenditures.

assessment plan proceeds as follows. Section I outlines the theory of change and main impact assessment questions. Section II describes the impact assessment design. Section III explains the sampling and data collection and Section IV concludes with the budget, deliverables and work plan.

Theory of change and main impact assessment questions

The theory of change behind the impact assessment for PRICE programme is driven by the development rationale of the programme regarding problems and opportunities around coffee and horticulture development in Rwanda (IFAD 2011a and IFAD 2011b). The coffee sector in Rwanda is characterized by smallholder farmers that often lack the necessary knowledge and productive capacities to reach high yields with high quality. Coffee Washing Stations (CWS), a mechanism for increasing coffee quality, are often improperly managed or dysfunctional and refrain smallholders from accessing promising markets with equitable market prices. The project, therefore, aims to increase the production and quality of coffee and invests in value-adding coffee washing stations to move smallholder farmers up the value chain. For horticulture, the main challenge is the high level of informal business arrangements; in 2001, 73% of the total production of horticulture crops in Rwanda was used for consumption and sales to local informal markets, and only 3% was sold in more formal regional and international markets. Rural finance institutions were, therefore, reluctant to grant loans to smallholder horticulture farmers. Against the background of growing demand for horticulture products, the PRICE project aims to break this circle by providing financial means to rural finance institutions that would lend these resources to competitive and promising horticulture smallholder farming investments.

In order to set up an effective impact assessment of the PRICE project, clear research questions need to be deduced from the causal logic embedded in the project's theory of change(Gertler, et al. 2016). We use a theory of change diagram to demonstrate the causal links between inputs/activities, outputs, outcomes and expected impacts of the project. Accordingly, this section starts with mapping the theory of change of the PRICE project to reflect the project logic, followed by the testable hypotheses, and the relevant impact assessment questions.

a. Understanding the PRICE programme

PRICE's approach builds on agricultural commercialization which is considered one of the main sources of poverty reduction for small farmers in the developing world (Dixon, Gulliver and Gibbon 2001). The approach seeks to strengthen farmers' positions in selected value chains through producing a considerable amount of cash crops, allocating resources to marketable cash crops, or selling a considerable proportion of agricultural outputs. The process of strengthening the marketing potential of farmers along the value chains includes both cash crops and traditional food crops (Jaleta, Gebremedhin and Hoekstra 2009).

Figure 1 depicts the theory of change for the activities of the PRICE project, and the assumptions upon which the project's activities are triggered so that the intended outcomes and impacts are specified. The core of this impact assessment is to investigate the extent to which the project help farmers increase

agricultural productivity and revenues, both of which have a direct implication on household-level income gains. We developed the theory of change reviewing project documents, consulting the relevant literature, and discussing with the project staff during the scoping mission which took place in July 2017. After this scoping mission, it was decided that impact assessment of the PRICE project would focus on evaluating two project components related to value chain (coffee and horticultural crops), and one financial assistance component of the project.

The coffee development component supports farmers through activities related to production, processing and marketing. For the production dimension, activities mainly include farmer field schools and advisory services to train farmers on best agronomic practices such as the adequate use of fertilizers, research activities that could help in producing high quality clones and eliminating major pests, and providing planting materials to expand plantation. For processing and marketing, the project supports the so-called the *Turnaround programme*, which seeks to improve the management of cooperative-owned coffee washing stations to generate higher profits for their members. The project also invests in the construction of coffee washing stations and rehabilitation of related access roads to them. In addition, the project supports cooperatives in accessing certification training to promote international certification, upon which coffee branding and exports could be promoted. Finally, for better relationships between farmers and other stakeholders in the value chain, the project supports the creation of a national coffee multi-stakeholder platform and sets up a coffee information system.

The horticulture development component is mainly focused on supporting new business models through financial and non-financial business development services. Horticulture farmers grow a number of crops, including: garlic, onions, beans, carrots, tamarillo, and flowers. On the financial side, the project encourages lending through matching grants, where qualified smallholders are given loans that are forgiven after repaying 50% of the debt. The non-financial sub-component consists of a package of interventions to encourage business partnerships that would allow for the commercialization of horticulture production. These partnerships include increasing capacity building, training farmers on best production practices, establishing value-chain linkages in these new agricultural markets, and supporting crop certification.

The financial services pillar is a complementary component to the coffee and horticulture development components to achieve their targets. For instance, this component assists in demonstrating the “bank-ability” of food crop growers; facilitating loans to buy inputs for production and raw material, and provision of assistance to insurance companies and commercial banks to develop new insurance products (coffee price insurance, weather index-based insurance and life insurance) are all intended to mitigate potential risks and, eventually, convince rural finance providers to provide more loans to the target group of PRICE.

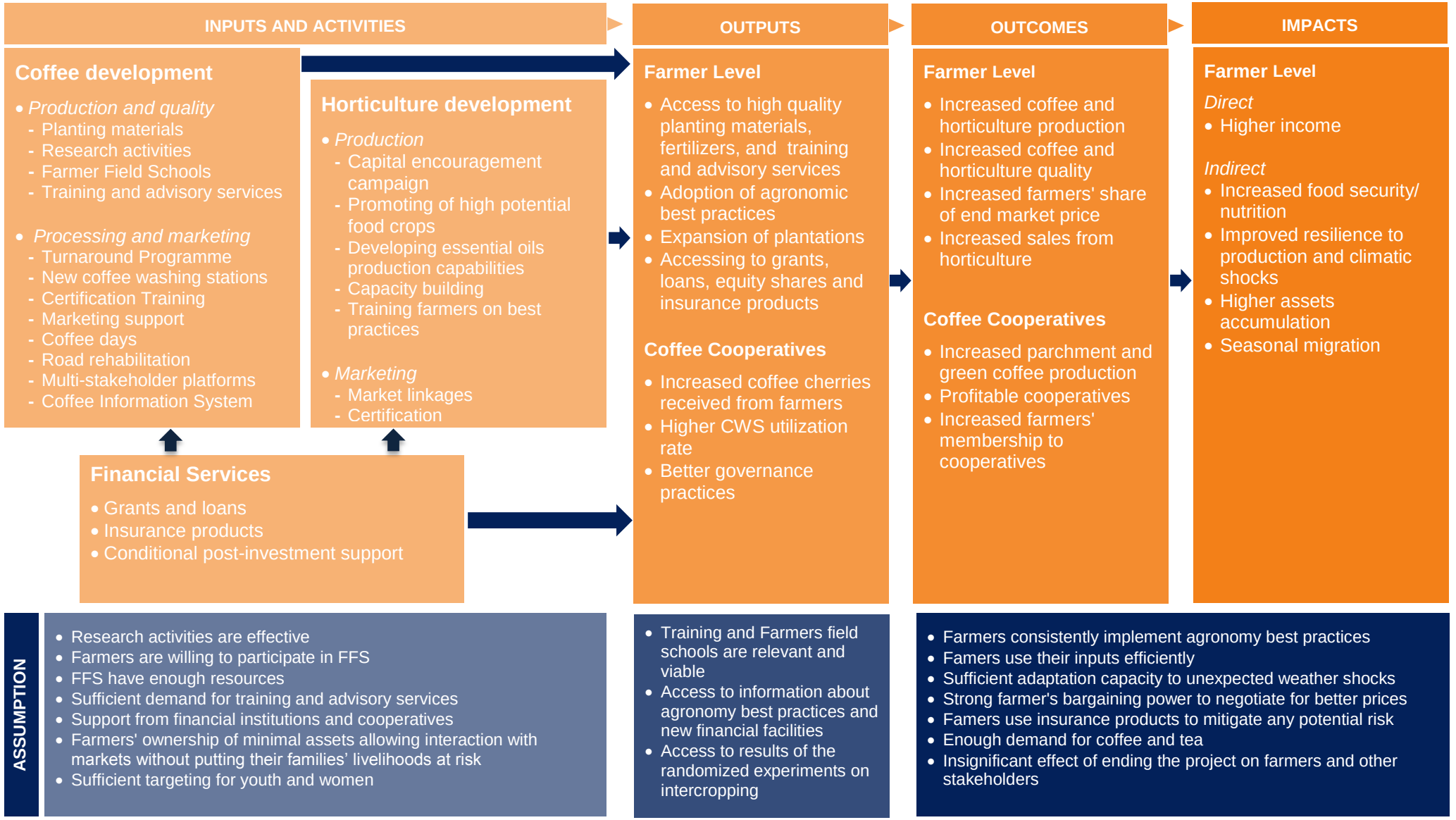
The previous activities assist in achieving some outputs on both farmers and cooperatives levels. On the farmer level, these include accessing high quality planting materials, fertilizers, and training advisory services, best agronomics practices, and loans. On the cooperative level, the Turnaround programme is helps enhance cooperatives' profitability, governance and management. The marketing and branding activities coupled with better-managed cooperatives assist farmers in accessing more remunerative markets.

All aforementioned outputs are expected to increase farmers' production and quality of coffee and horticulture, and secure higher returns to farmers in both sectors (Rejesus, et al. 2009 and Davis, et al. 2012). At the same time, the increase in farmers' income might lead to additional indirect impacts, such as increased food security and nutrition (Larsen and Lilleør 2014; Mark, et al. 2012 and Jodlowski, et al. (2016), improved reilience to production and climatic shock, higher assets accumulation, and seasonal migration. It should also be noted that interactions between different activities could intensify the intended impacts (e.g., being trained in FFS coupled with having a conditional loan/grant would create a greater incentive to be more efficient and productive).

The causal pathways presented in the theory of change to achieve the intended results are implicitly contingent upon some assumptions. These include the activities' appropriateness to the context, sufficient demand for relevant activities, farmers' capacity to absorb and implement activities, sufficient demand for the products of interest (horticulture and coffee in our context) and enough targeting to rural women. For sustainability of the project's impacts, one needs to assume that farmers and other stakeholder will not alter their behaviour and motivation once the project is completed.

The project could also contribute to achieve wider results through externalities, as well as general equilibrium effects. Unintended externalities may include knowledge transfer to non-beneficiary farmers from farmers who attended farmer field schools or received advisory services. In addition, branding and international certification activities could be an incentive to non-beneficiary farmers to enhance the quality of their crops and increase their production. Having been excluded from the treatment of receiving a matching grant could also negatively affect non-beneficiary farmers (Duflo, Glennerster and Kremer 2007). A general equilibrium effect of the project on coffee and horticulture prices could also take place, which in turn, might affect non-beneficiary farmers.

Figure B. 1: Theory of change of PRICE



b. Impact assessment questions

While the coffee development component is typically considered to have greater income generation potential for smallholder farmers, project documentation and interviews with project staff suggest that horticulture investments results are showing promising results. According to the medium term review of the PRICE project in 2015, the Turnaround program was also showing positive results, whereas the farmer field school-related investments suffered from delays in procuring a qualified service provider (IFAD 2015f). As a consequence, the contractor only trained 10,000 farmers instead of the initially planned 72,400 farmers.[2] In addition, a recent systematic review on FFS by the International Initiative for Impact Evaluation (3ie) demonstrates the extensive existing literature already produced on these interventions (Waddington, et al. 2014).

Our quantitative assessment will thus mainly focus on the impact of and the Turnaround programme (TAP) for coffee and on the provision of matching grants for horticulture. Other dimensions in these two components such as the effects of marketing, branding and promotion will be captured through additional questions in the survey and/or focus group discussions with beneficiaries. This will help to establish evidence on whether receiving more than one intervention affects the magnitude of the impact of the interventions of interest.

Although the ultimate goal is to assess the impact of the interventions of interest on smallholder coffee and horticulture farmers, the plan is also to evaluate the impact of the Turnaround programme on the cooperatives themselves. Specifically, we are interested to show how the programme affected cooperatives ' governance, financial and technical situations. Therefore, this impact assessment will focus on three dimensions:

1) The impact of the Turnaround programme on coffee cooperatives.

2) The impact of the Turnaround programme on coffee farmers who are cooperatives' members.

3) The impact of the matching grants on horticulture farmers.

Some testable questions could be derived from the aforementioned theory of change regarding the Turnaround programme and the matching grants. Following the same logic of its results chain, the questions are divided into two types, namely the main question and intermediate questions. The former focuses on assessing the impact of the project's interventions on the intended results, while the latter tackles the mechanisms through which those results are achieved.

Main questions

1. Does the project lead to significantly increased farmers' income for coffee producers?

2. Does the project lead to significantly improved cooperatives' governance, financial and technical situations?

3. Does the project lead to significantly increased farmers' income for horticulture producers?

4. Conditional on increased income, how does the project indirectly affect patterns of food and seasonal migration, resilience and assets accumulation for coffee and horticulture farmers households?

Intermediate questions

a) Does the Turnaround program improve farmers' coffee production and quality?

b) Does the Turnaround program improve cooperatives' access to markets?

c) Does access to matching grants improve farmers' production and sales of horticulture crops?

d) Does the exclusion from getting the matching grant negatively affect farmers' production and sales of horticulture crops?

[2] The service provider was contracted again in 2016 to train an additional 30,000 farmers up until the end of 2017.

To answer the questions above, one needs to be mindful of the time span to realize the intended impacts. For example, increasing in production could take place in the short-run, whereas a change in income could be realized in the medium or the long run (Winters, Salazar and Maffioli 2010).

c. Project coverage and targeting

PRICE targets smallholder farmers who are poor, have limited assets and are willing to commercialize their production. The main target group of the project is the low-income agriculturalists who account for 24.1 percent of the population. They belong to households that depend predominantly on agriculture to sustain their livelihood (96%) and income (92%). The project also includes agriculturalists with medium/high income, agro-pastoralist and agro-labourers.

The selection criteria and the implementation were different between coffee and horticulture interventions. For the Turnaround programme, there were two rounds of TAP under PRICE spanning a period of two years- over 2014-2015 for the first round (TAPI) and 2016-2017 for the second round (TAPII). They targeted 50 existing coffee cooperatives (25 for each round) to assist in building capacity, operational and governance of coffee cooperatives so that they could be able to get access to finance and market in the future and recover from years of losses, so the eventual aim of the TAPI was to make coffee cooperatives profitable so that smallholder members could benefit.

- *Turnaround programme (Coffee)*

The coffee cooperatives selection for both rounds was conducted by SNV-Rwanda [3] and validated by NAEB/PRICE4, but the selection was done slightly different for both rounds. Regarding the TAPI, they used the following criteria for the prescreening: 1) Whether the CWS made profit during the last 3 years (2011, 2012, 2013); 2) whether the CWS functioned at all since 2010 and was willing to pursue their activity in the short term; and 3) whether CWS were under a long term rental contract for the 2014 coffee season. A group of 52 coffee cooperatives were preselected to be scored according to their performances in three main dimensions as shown in Table 1, namely cooperative governance, financial profile, and technical potential. After excluding 8 cooperatives due to insufficient information or because they recorded profits for the past three years, they ultimately considered 44 coffee cooperatives, of which 25 cooperatives were selected to receive the TAPI.

[3] SNV-Rwanda is a development organization, founded in the Netherlands in 1965 to equip communities, businesses and organisations with the tools, knowledge and connections they need so that they are empowered to break the cycle of poverty and guide their own development. They have been engaged in strengthening the coffee sector in Rwanda jointly with national Agricultural Export Development Board.

[4] NAEB/PRICE is the National Agricultural Export Development Board, which is responsible for guiding and managing all activities of the PRICE project implementation.

Table 1: Selection Criteria for the TAPI

Dimension	Sub-Dimension	Maximum scores
Cooperative Governance	Availability documents as required by the law	5
	Cooperative organization	4
Financial Profile	Profitability	4
	Financial potentiality	4
	debts status	4
Technical Potential	Coffee washing station (CWS) area productivity	4
	CWS performance	4
	CWS status	4
	Management team	4
	Provision of premium price and/or second payment to the farmers	4
Total		**41**

Note: There are some pillars under each sub-dimension, upon which the scores were given.

With respect to the TAPII, they pre-screened 89 coffee cooperatives using the following criteria : 1) CWS unable to make a profit in previous years and demonstrates the potential to become profitable within two years; 2) CWS management demonstrates a strong commitment to maintaining high standards of good governance, accountability and transparency; and 3) CWS management demonstrates a commitment and the ability to pass premium prices to farmers. In addition, criteria on cooperative governance, financial profile and technical potentiality were considered for the selection of cooperatives. The cooperatives that were not operational this year, rented out to a private party, or bankrupted, were not selected. Out of the pre-screened 89 coffee cooperatives, SNV in consultation with NAEB/PRICE shortlisted 64 coffee cooperatives, of which they selected 25 cooperatives with the highest potential for viability and sustainability to receive the TAPII.

- *The matching grants (Horticulture)*

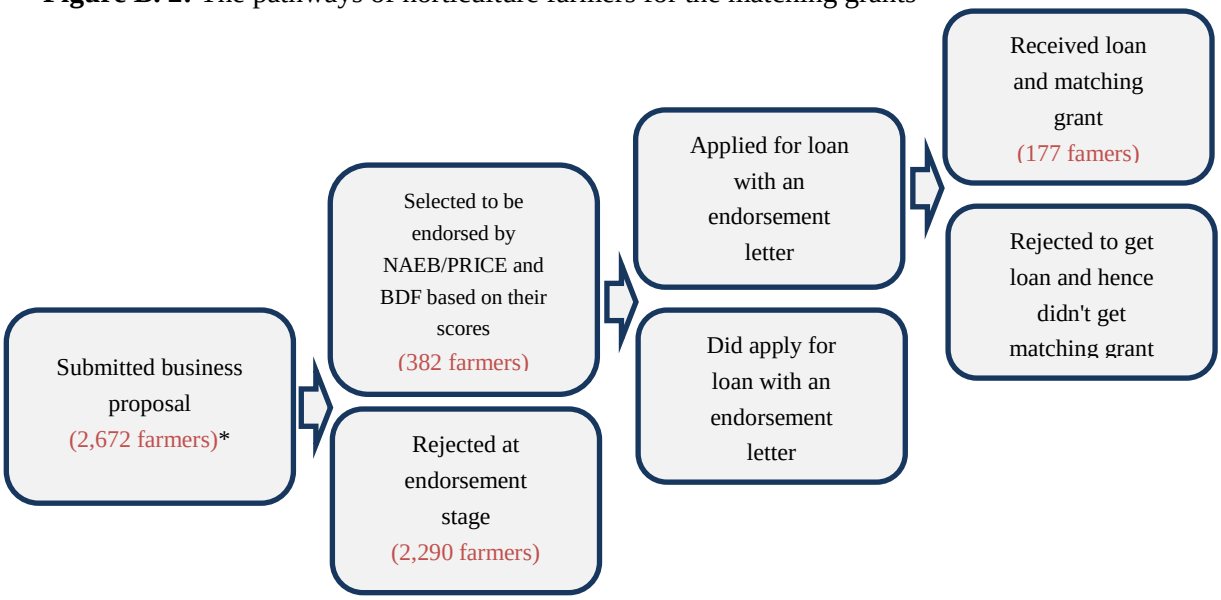
The activities in horticulture component of PRICE project are designed to be implemented under a business partnership approach. One way to facilitate the access to financial services for this business partnership was to provide performance-based grants (matching grants) to farmers. PRICE implemented matching grants for horticulture that consists 50% grant and 50% loan as follows:

1) The PRICE project deposits 50% of the grant in an interest-bearing account opened at the lending bank as soon as a financial institution has approved the investment.
2) One third of this 50% (approximately 16.7%) would be used to reduce the investment cost (the estimated cost of a project).
3) The financial institution will extend a loan to the borrower for the rest of 83.3% of the investment cost.
4) The borrower will stop paying back his/her loan once he/she has paid pack 50% of the investment cost.
5) The bank will offset the outstanding loan principal with the balance of the deposit made by the PRICE project.

To implement the matching grants in the horticulture sector, NAEB/PRICE launched an open call for proposals to submit business ideas on October 1st, 2013. After submission of prospective project ideas, NAEB/PRICE selected

projects based on specific criteria as explained later. The selected project were submitted to BDF (Bank of Rwanda Development Fund)[5] for technical assistance with the business plans before the applicants applied for loans from the financial institutions. Figure 2 demonstrates the different applicant pathways.

Figure B. 2: The pathways of horticulture farmers for the matching grants



***** We focus only on individual farmers which represent 85 percent of all applicants. Other applicants include cooperatives and corporates.

To check whether the business proposals are eligible to be endorsed to apply for the matching grant, they assigned a score out of 100 based on the selection criteria as indicated in Table 5. In addition, there are other factors are prerequisites to go through this assessment as follows: 1) the project must be implemented in Rwanda; 2) projects should focus on either primary production or post-harvest; and 3) crops should be one of the following: pineapple, onions, hot peppers, tamarillo, passion fruits, tomato, apple banana, carrots, eggplants, French beans, cabbage, flowers, essential oils crops, avocado, avocado, mango, and citrus.

Table 2: Selection criteria used for scoring horticulture applicants

Dimensions and Sub-Dimensions	Score
Market potential/Potential for export/opportunity for differentiation/value-Adding	20
Ensured markets	15
Project feasibility related to experience and interest of applicant	15
Project feasibility related to business idea/impact	25
Project feasibility related to investment cost and financing	15
Sustainability	5
Meets PRICE Project criteria	5
Total	**100**

(NAEB 2014)

[5] BDF was established in 2011 as a wholly owned subsidiary of the Development Bank of Rwanda (BRD). Its main objective is to assist SMEs to access finance, particularly those without sufficient collateral to obtain credit from traditional financial institutions at reasonable rates.

The selection team had to put more importance to crops with high value added than other vegetables and fruits to be undertaken in primary production. That's why they ended up with different pass mark for each crop type. The following table indicates the pass mark of each crop type (from 50% to 80%). They received 2673 applicants, out of which NAEB/PRICE and BDF endorsed 382. BDF ultimately supported 177 applicants for the matching grants due to limited funding available from the PRICE project.

Table 3: Pass Marks for different horticulture crop types

Activity sector	Crops	Required pass mark
Value-Adding Sectors	All crops that involved processing, post-Harvest, packaging, transport and marketing	50%
Primary Production	Essential Oils & Flowers	
Primary Production	Onions & Passion fruit	75%
Primary Production	Apple banana & Pineapple	
Primary Production	Other Vegetables & Fruits	80%

(NAEB 2014)

- *Geographical coverage for both interventions*

In terms of the geographic distribution of the interventions, the project mostly covered selected areas from all provinces in Rwanda as indicated in Table 3.

Table 4: The Target Areas of the Turnaround Programme and Horticulture Matching Grants

Province	Target districts for coffee	Number of cooperatives received the tap	Target districts for horticulture	Number of farmers received the matching grants
West	Karongi	2	Karongi	2
	Ngororero	2	Ngororero	1
	Nyabihu	1	Nyabihu	1
	Nyamasheke	5	Nyamasheke	1
	Rusizi	3	Rusizi	5
	Rutsiro	3	Rutsiro	3
			Rubavu	42
South	Gisagara	5	Gisagara	1
	Huye	1	Huye	1
	Kamonyi	4	Kamonyi	7
	Nyanza	4	Muhanga	1
	Ruhango	2	Nyamagabe	1
East	Gatsibo	2	Gatsibo	2
	Kayonza	2	Kayonza	2
	Kirehe	3	Bugesera	3
	Ngoma	2	Ngoma	1
	Nyagatare	1	Nyagatare	2
	Rwamagana	4	Rwamagana	6
North	Gakenke	2	Burera	4
	Rulindo	1	Rulindo	20
			Gakenke	9
			Gicumbi	13
			Musanze	40
Kigali			Gasabo	2
			Kicukiro	3
			Nyarugenge	3
			Rusororo	1

Impact assessment design

a. Constructing counterfactual groups

This impact assessment aims to evaluate the extent to which a set of outcomes has been changed due to the PRICE project. Comparing outcomes of the treated farmers with non-treated farmers coupled with lack of ex-ante randomization would lead to biased impacts estimation given that it might confound inherent differences between two groups. In addition, comparing outcomes of the treated farmers pre and post the interventions would not be accurate as it might confound trend effect over time (Angrist and Pischke 2009). One way to mitigate these potential biases is to use propensity score matching, which helps to artificially construct a non-treated group of farmers that have the most similar characteristics to the treated group based on a set of observed characteristics. A propensity score matching technique will be used to create the counterfactual groups of coffee and horticulture farmers, but the implementation procedures are different based on the data availability as explained in the rest of this section.

Within the coffee component, we plan to assess the effectiveness of the turnaround cooperative program, which included the provision of coffee washing stations. The turnaround program aims to increase the profitability of coffee cooperatives by improving cooperative governance, financial management, coffee growing practices, and access to markets. Given the large number of cooperatives and the limited amount of access to the program, we intend to develop our counterfactual by comparing farmers within treated cooperatives to similar farmers who belonged to cooperatives without access to the program. We will employ a two stage matching procedure, first at the cooperative level and then determining similar farmers within those cooperatives.

While the horticulture component contained multiple sub-projects, it mainly provided matching grants to farmers wanting to grow horticulture for sale. These farmers grew a wide array of items, including garlic, onions, beans, carrots, tamarillo, passion fruit, and flowers. This funding mechanism provided smallholder farmers with access to capital through bank loans. These households were previously overlooked by banks, which focused on large scale commercial farms. The matching grants were heavily oversubscribed, with over 3000 applications for less than 500 grants. The project officials collected limited data on the applicants, which should allow for a basic difference in difference approach with matching and the tracking of rejected households as well as project beneficiaries. Given the larger number of grant applicants, the research will evaluate farmers who received funding, those who were rejected, and a pure control who did not apply.

b. Selection bias

Given certain data limitations, including baseline and implementation information, selection bias is a valid concern for this study. Generally, Rwanda receives a significant amount of development aid, which may bias our causal estimation procedures. The lack of an impact assessment baseline before these projects began increases our internal validity concerns. Given the potential fragility of matching results, we intend to validate our findings using multiple estimation strategies, including inverse propensity score weighting and nearest neighbor matching techniques.

One of the reasons for potential selection bias within matching is due to the lack of established power calculation methods for these approaches. To maximize the likelihood of finding a valid counterfactual, we will follow standard procedures and increase the minimum sample size by 5%. This enlarged sample size increases the likelihood of

discovering strong matches for the treatment households. By broadening the sample size, we also hope to increase the width of the common support.

Selection bias is also possible due to our ability to collect only one data point for most households and our inability to account for unobservable household and individual characteristics. We hope the vagaries of weather, geopolitical changes, and other factors will similarly affect treatment and control households. But certain conditions, like the severe drought currently afflicting Rwanda, may influence the validity of the matching assumptions.

Finally, some PRICE interventions (e.g., the Turnaround programme) are implemented through other projects by the government or other development agencies. Also, a number of other development projects, from IFAD and other agencies, are occurring simultaneously in Rwanda. There is potential for overlap in smallholder project beneficiaries. Given these numerous projects, we will include questions on program benefits in our questionnaires and then control for these situations when they occur.

c. Potential for spillovers

There are a number of potential spillovers, which could lead to underestimates of the project results. Given the aforementioned data limitations, it will be difficult for us to quantify these spillovers in this impact assessment.

The coffee project benefits may assist farmers beyond the treatment groups. The farmers could share the Turnaround best practices with others, or the coffee washing stations might be shared with farmers outside the cooperative, which would potentially influence the matching comparisons. Additionally, the Government of Rwanda's National Agricultural Export Board regulates the coffee market, meaning that programme gains might be spread well beyond the beneficiary group.

The potential for horticulture spillover benefits is high, given the limited barriers to entry for growing these crops. Production for sale could be diverted to consumption, possibly beyond the farmer's household. Successful practices might be shared with farmers not receiving access to capital. And for those reject applicants, it is unclear if capital sharing or the potential for future capital might incentivize their growing decisions.

Sampling and data collection

a. Key indicators

Based on the theory of change and the impact assessment questions, some indicators are selected to reflect the focal of the PRICE interventions. The key impact indicators and intermediate outcomes on the household level are presented in the following Table.

Table 5: List of key and intermediate indicators and their measures on the household level

Indicator	measure
Key impact indicators	
Income	Household level income data by source
Food Security	Food Insecurity Experience Scale
Resilience	Ability to recover from negative production and climatic shocks
Assets	Durable assets, livestock assets and housing assets
Migration	Seasonal migration
Intermediate indicators (Farmers level)	
Cultivated area	Area (ha)
Inputs used	Value of inputs used
Productivity	Yield per hectare
Crop market participation	Value of crop production sold
Quality	Coffee grades produced by farmers (subjective measure by farmers)
Intermediate indicators (Cooperatives level)	
Production	Parchment and green coffee production
Profits	Cooperative's profits
Inputs used	Value of inputs used
Farmer's membership	Number of farmers who are members
CWS utilization rate	The percentage of current production compared to the highest level the CWS would achieve if working on full capacity
Governance practices	Whether the cooperative have a registration certificate, minute book and shares book, etc.

Some indicators on coffee cooperative level are included given that we will also assess the impact of the Turnaround on coffee cooperatives. Therefore, other indicators will be used on the cooperative level, such as production, profitability, sales, membership, and CWS performance. These indicators are now being collected by a local consultant in Rwanda.

b. Quantitative data collection strategy and instruments

The data collection strategies for coffee and horticulture are not similar. For the coffee Turnaround programme, we match on the cooperative level, within which we will choose our sample of coffee farmers. Our sample will be distributed equally between the treatment and control groups. For the horticulture matching grants, we could implement the regression discontinuity setting given that all business proposals were scored and there were thresholds, based on which applicants were selected to be endorsed to apply for the matching grant. However, one could argue that the exclusion from getting the grant is another treatment and needs to be assessed. Accordingly, we plan to have another group of horticulture farmers who did not apply for the matching grant to be used as a control group.

Sampling strategy

- *Turnaround programme (Coffee)*

To assess the impact on the smallholder farmers who are cooperative members, we first plan to create a counterfactual group of coffee cooperatives that are similar to the treatment group of coffee cooperatives that received the TAP. We will then randomly select farmers from within both the treatment and counterfactual groups to be interviewed. The ultimate goal is to create a comparable group that closely represents what farmers from within the treatment group would have experienced if their cooperatives did not receive the TAP. We will then compare farmers' outcomes from both treatment and counterfactual groups to determine the impact of TAP on smallholder farmers.

Our strategy will differ for creating the counterfactual group for the TAPI and TAPII treatment groups. For the TAPI, we will use the scores that were given to the coffee cooperatives by SNV-Rwanda based on the aforementioned selection criteria. The notion is that if two coffee cooperatives- only one of which has received the TAPI - was assigned the same score, it would reflect the same level of performance for both of them. Therefore, given their similar scores, one could use the cooperative which didn't receive the TAP as a counterfactual to the one that received the programme.

With respect to the TAPII, given that there were no scores assigned to the cooperatives in the selection process, we use a propensity score matching to create the counterfactual group for the treatment group of the TAPII. We start by calculating the propensity scores that reflect the probability of receiving TAPII for each cooperative. These scores are based on the cooperative's observable characteristics. Observing similar propensity score for two cooperatives, one that did and another that did not receive the programme means that the latter is a good comparison for the former. This comparison infers that both cooperatives are similar in terms of their observable characteristics. The crucial assumption is that those cooperatives' observable characteristics should influence the participation in TAPII and the outcome variables at the same time, but are not affected by the treatment as we are using ex-post data. Because the TAPII was implemented over 2016-2017, we use data for 2015 to satisfy the aforesaid assumption.

- *The matching grants (Horticulture)*

To assess the impact of the matching grants on horticulture farmers, we focus on farmers who got the endorsement letter and applied for loan as it represent a setting close to the RCT one given that they are similar based on their

observable and unobservable characteristics. In this case, our treatment group would be farmers who received loan and matching grant, whereas the control group would be farmers who applied for loan after getting an endorsement letter but they didn't get it and hence didn't get matching grant. This setting is ideal to estimate a causal effect of the matching grants. The crucial assumption in this context is that those who were rejected to get loan were not different in terms of their unobservable characteristics compared to those who were accepted to get loan. Our logic for this assumption is that both groups passed the same scoring selection criteria and they applied for loan after getting an endorsement letter, so they are similar in both observables and unobservable characteristics. The former is reflected in the selection criteria, whereas the latter is reflected in their decision to apply for loan.

Given that we don't have enough information about how many farmers who got an endorsement letter did apply for loan, which could affects the validity of our identification strategy, we introduce two alternative approaches: a regression discontinuity design (RDD) and a propensity score matching (PSM). These approaches could also represent diagnostic checks for our previous approach.

As a first alternative approach, we might use an RDD to assess the impact of the matching grants on horticulture farmers given that the assigned scores could be used to create the counterfactual for our two levels of treatment (382 applicants). The first level includes those who applied, were endorsed but receive neither loan nor matching grant (205 applicants). The second level includes those who applied, were endorsed and received the grant (177 applicants). Our approach argues that applicants near to the thresholds are similar in terms of their observables and non-observable characteristics, given that they could not manipulate their scores (Lee and Lemieux 2010). Therefore, the assignment to the treatment is considered randomly for those who are near to the thresholds. It worth mentioning that we are proposing the RDD as an alternative option, but we need to observe the outcome variable (in our case income) to check whether there is a discontinuity around the thresholds.

Having two level of treatment would help in answering the following two research questions: 1) how did the matching grant affect horticulture farmers' income and other relevant wellbeing indicators?; and 2) how being excluded from receiving treatment could affect horticulture farmers differently? Both questions are policy-oriented, while the latter is also methodological-oriented.

One could argue that we don't have enough observations around the thresholds. However, according to Lee and Lemieux (2010), we can't only use applicants close to the thresholds and have to use data away from them to get reasonable results. Yet, one needs to take into account how sensitive results would be to different bandwidths used. As followed in the literature, we will start with a narrow bandwidth and then check how our results will be sensitive with widening the bandwidth. Given that the threshold different according to the crop type, we standardize them around their corresponding threshold. This would help ease the comparison between them as well as the regression analysis when we combine all crops in one model.

Another argument could be that observing the almost same score for two applicants doesn't necessarily reflect similarity between them given that that they could have different combinations of disaggregated scores. Nevertheless, the almost same score of two applicants would reflect the same level of potentials for both applicants to succeed in their proposed business idea if implemented, although the disaggregated score might be different. Therefore, one applicant could be used as a counterfactual for the other one.

It is worth mentioning that the feasibility of implementing the RRD in our context would be corroborated once we observe our main variable of interest (income). However, at this point, the applicant's scores would help select our treatment and control group given that observing the same score for two applicants reflect that they are similar in terms of their potentials.

As a second alternative approach, we might use a propensity matching approach to match between selected applicants (382 applicants) and rejected applicants (2,290 farmers) based on their observable characteristics.

Results for both coffee and horticulture are in Appendix A and Appendix B.

Sample size calculations

Given that it is costly and usually impossible to get data on the whole population of interest, the standard practice is to study a representative sample of that population, through which some inferences on the population are made. The critical issue is to determine the optimal size of the sample, to allow for the detection of a significant effect, while avoiding an impractically large sample. In this context, power calculations play a crucial role to assess the trade-offs between costly data collection and gains from greater precision of the impact assessment.

The optimal sample size is affected by various factors including the expected change in the outcome of interest. We use the World Bank's formula to determine the optimal sample size for both coffee and horticulture matching exercises (Winters, Salazar and Maffioli 2010).

$$\boldsymbol{N = \frac{4\sigma^2(Z_{\alpha/2} + Z_{\beta})^2}{D^2}[1 + \rho(M - 1)]}$$

The formula incorporates the expected minimum change in the outcome variable "$\boldsymbol{D}$", its standard deviation $\boldsymbol{\sigma}$, the critical values of the confidence interval "$\boldsymbol{Z_{\alpha/2}}$" and statistical power "$\boldsymbol{Z_{\beta}}$", the minimum number of units to be sampled within each cluster "$\boldsymbol{M}$", and the intra-cluster correlation of the unit of analysis "$\boldsymbol{\rho}$". The latter indicates the extent to which the overall variance is explained by within group variance. The required minimum sample size increases with a higher variance in the outcome variable, higher intra-cluster correlation, the bigger the required number from each cluster.

Some figures in the previous formula need to be estimated (e.g., the standard deviation of the outcome variable), whereas the rest are standard figures (e.g., the critical values). We use the critical values related to two-tailed test based on the fact that we will assess whether specific intervention had an impact or not. For the expected effect size and standard deviation of the outcome, we estimated them based on the annual income average of the coffee and horticulture farmers from the Rwanda-Integrated Household Living Conditions Survey (2013-2014). The horticulture includes the top three crops (onion, pineapple and tomato), for which farmers obtained the matching grant.[6] As indicated in IFAD (2016b), the percentage changes in income for coffee and horticulture are expected to be 28% and 98% by 2018, respectively. However, we use 22% for coffee farmers and 49% horticulture farmers, both of which were detected in a recent study (IFAD 2016b). Based on existing data, we assume a 0.05 intra-cluster correlation and a

[6] Flowers were one of the top crops, but we didn't have relevant information.

sampling of at least 19 units of observation per cluster.[7] Yet, the qualitative results might lead to change how many observations from each cluster.

Table 6: Figure used in the sample size calculations for coffee and horticulture

Coffee	Horticulture
$Z_{\alpha/2} = 1.96$ $Z_{\beta} = 1.28$ $\rho = 0.05$ $M = 19$ $\sigma = 433,891$ RWF Outcome Average $= 301,360$ RWF ($290,607$ for the poor)	$Z_{\alpha/2} = 1.96$ $Z_{\beta} = 1.28$ $\rho = 0.05$ $M = 19$ $\sigma = 792,338$ RWF Outcome Average $= 333,086$ RWF ($285,452$ for the poor)

Using the previous parameters, a sample size of 2558 coffee farmers and 2109 horticulture farmers are recommended to detect a 22% and 49% income increase for coffee and horticulture farmers. Nonetheless, we inflate our sample by 5% to account for households being unavailable or not suitable for matching. Therefore, a sample size of **2686** coffee farmers and **2214** horticulture farmers are required as indicated in Table 7.

Table 7: The estimated sample size for coffee and horticulture

Crop	D	Sample size	Sample size+5%
Coffee	84,380 (28%)	1582	1661
	66,299 (22%)	**2558**	**2686**
Horticulture	326,424 (98%)	531	558
	163,212 (49%)	**2109**	**2214**

According the distribution of the sample for coffee, the selected sample size will be divided equally between the treatment and control groups. For horticulture, the sample size will be allocated between the selected projects, rejected projects, and projects that did not apply for the matching grants.

c. Qualitative data collection strategy and instruments

Besides conducting the quantitative analysis that assesses the impacts of the main interventions, some qualitative data collection will be carried out. The latter will firstly enable to get additional information about the project implementation in terms of targeting and the context surrounding the implementation. Furthermore, it is considered as a validation tool to our quantitative results through getting insights about the mechanisms which may explain any change in our key impact indicators.

The qualitative data collection will be done through focus group discussions (FGDs) and in-depth interviews with coffee and horticulture specialists from the national agriculture export development board, cooperatives that received

[7] The intra-cluster correlation was calculated on the district level instead of the sector level as there is no data on the latter (source for the former: Rwanda-Integrated Household Living Conditions Survey (2013-2014)). It is very low for both coffee (0.002) and horticulture (0.009). Therefore, we decided to choose a stricter correlation coefficient (0.05) as we expect it to be higher at the sector level.

support through the Turnaround programme, members of the new coffee washing machines that were installed by the program (in case we will evaluate this as well), non-treated cooperatives and coffee washing machine holders, microfinance institutions providing matching grants and other financial services to farmers, and some selected and rejected project owners for the horticulture grant scheme.

The FGDs and in-depth interviews will focus on the following topics:

- Description of the interventions of interest, namely the Turnaround programme and the horticulture grant.
- Effectiveness and sustainability of these interventions.
- Supporting and hindering factors to reach to the intended impacts of the interventions. Possible positive spillovers and negative externalities that raised from the interventions.
- Discussion around how IFAD could further support both Coffee and Horticulture sectors.

Budget, deliverables and work plan

a. Budget

The data collection activities will be carried out by Research Solutions Africa team selected after a competitive tender process. Research Solutions Africa has proposed the following budget for the data collection activities (Table 8).

Table 8: Tentative Itemized Budget

Item	Proposed cost (US$)
Inception meeting, desk study, training of enumerators	18 112
Sampling and Pretesting (All tools)	3 529
Fieldwork - Data Collection	49 769
Transport	71 461
Professional Fees	74 575
Miscellaneous, Equipment, Stationery Supplies	7 461
RSA Administrative costs (rentals, consumables and utilities)	74 219
Total	299 126

b. Deliverables

- Complete, cleaned, quantitative dataset, along with audio transcripts of qualitative interviews.
- Impact evaluation report, incorporating the findings from the quantitative and qualitative data. The report will provide a summary report on the effectiveness of the project sub-components being evaluated.

c. Work plan

Table 9: Work plan schedule

Activity	Timeframe
Data Collection	
Scoping mission, including preliminary qualitative interviews	23 – 29 July 2017
Hiring the data collection firm and survey instrument finalization	1 September – 30 November 2017
Conducting quantitative survey (*Coffee Cooperatives*) by a local consultant	20 November – December 31 2017
Qualitative surveys	4 December - 15 December 2017 (2 weeks)
Enumerator training and survey piloting	8 January – 12 January 2018 (1 week)
Conducting quantitative survey (*Coffee farmers*)	15 January – 9 February 2018 (4 weeks)
Data processing, data quality review, and data set completion (*Coffee farmers*)	12 February – 23 February 2018 (2 weeks)
Conducting quantitative survey (*Horticulture farmers*)	12 February – 9 March 2018 (4 weeks)
Data processing, data quality review, and data set completion (*Horticulture farmers*)	12 March – 23 March 2018 (2 weeks)
Data analysis and report production	
Data analysis (Coffee)	26 February - 16 March 2018 (3 weeks)
Data analysis (Horticulture)	26 March - 13 April 2018 (3 weeks)
Report completion	21 May 2018

Table 10: Impact Assessment Team

Name	Role	Affiliation
Alessandra Garbero	Principal Investigator	RIA, IFAD
Tim Balint	Co-Principal Investigator	RIA, IFAD
Mohamed Abouaziza	Research Analyst	RIA, IFAD
Benjamin D Wood	Senior Evaluation Specialist	3ie
Ameet Morjaria (TBC)	Assistant Professor	Kellogg School of Management, Northwestern University

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Appendix A: Matching Results for Coffee Farmers

Before presenting the matching results, we assess the differences between the cooperatives that received TAPI with those that received TAPII using data of 2012. As shown in Table 2, TAPI cooperatives produce more coffee compared to TAPII, but they are not statistically significant in terms of capacity utilization rate of their CWSs and the total spare parts needed for their CWSs. Our findings reflect that the PRICE project firstly targeted the more promising cooperatives in terms of their potentials to achieve profits.

Table A. 1: Differences between cooperatives of TAPI and TAPII

Variables	TAP1	TAP2	t-value	p-value (Ha: diff > 0)
Cherries coffee	185.95	132.48	1.5491**	0.0644
Parchment coffee	37.19	26.48	1.5527**	0.0640
Green coffee	27.86	19.83	1.5593**	0.0632
Theoretical utilization capacity	273.81	256.52	0.3307	0.3712
Capacity utilization rate	-195.29	-199.04	0.0645	0.4744
Total spare parts	5.40	5.81	-0.1887	0.5743

Regarding the matching of TAPI, the assigned scores were between 20/41 (lowest performance) to 37/41 (highest performance). Most of the cooperatives in the top of the list were selected to participate in the TAPI, but fortunately not all of them, which gives us the chance to claim that those which were not selected and have similar scores to those that participated in the TAPI are similar based on their characteristics related to the selection criteria: cooperative governance, financial profile, and technical potential. Based on this argument, as shown in Table 3, we end up with 8 coffee counterfactual coffee cooperatives to our 24 coffee cooperatives that received the TAPI .

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Table A. 2: The Matching Results for the TAPI

Score	Treatment				Control			
	Coop	Province	District	Sector	Coop	Province	District	Sector
37	IZERE COFFEE	Southern	Nyanza	Muyira	Shara coffee	Western	Nyamasheke	Kagano
	BUHANGA COFFEE	Southern	Gisagara	Musha				
	Gisuma coffee	Western	Rusizi	Giheke				
36	Gishyita coffee	Western	Karongi	Karongi	Gashonga coffee	Western	Rusizi	Gashonga
	Bwishaza coffee	Western	Rutsiro	Gihango				
35	MIZERO COFFE	Southern	Nyanza	Mukingo	TWONGERE KAWA COKO	Northern	Gakenke	Coko
	Mukindo Coffee	Southern	Gisagara	Mukindo	COPROFICAG	Western	Rusizi	Gitambi
34	KOPAKABI	Eastern	Rwamagana	Karenge	Shining coffee	Eastern	Bugesera	Musenyi
	TWISUNGANE	Eastern	Kayonza	Murama				
	Tuzamurubukungu	Eastern	Kirehe	Mpanga				
33	MCAC	Eastern	Rwamagana	Muyumbu				
	Gisaka coffee	Eastern	Kirehe	Mushikiri				
	Mwezi coffee	Western	Nyamasheke	Karengera				
	Nyamirundi	Western	Nyamasheke	Nyabitekeri				
32	Nyarubaka Coffee	Southern	Kamonyi	Nyarubaka				
	Kayonza coffee coop (KCC)	Eastern	Kayonza	Nyamirama				
	COCANA/Nasho coffee	Eastern	Kirehe	Nasho				
	Vunga coffee	Western	Nyabihu	Jomba				
	CODECABU	Western	Rusizi	Gikundamvura				
31	KOTUKANYA	Western	Rusizi	Gitambi				
30	KIREZI COFFEE	Southern	Nyanza	Nyagisozi	MAYOGI COFFEE	Northern	Gicumbi	Muko
	Abakangukiyekawa coop.	Eastern	Ngoma	Gashanda				
26-29	Gasange coffee	Eastern	Gatsibo	Gasange	Mayaga coffee	Southern	Ruhango	Ntongwe
	COOCAN- Duhuzimbaraga	Western	Nyamasheke	Karambi	Kinyaga coffee	Western	Rusizi	Nkanka

For the TAPII, We use data for 2015 for our matching exercise. For the probability model, we use the following indicators: 1) whether the cooperative received the TAPI; 2) whether the cooperative received the TAP from other project before PRICE; 3) Capacity utilization rate of CWS; 4) Theoretical capacity in cherries; 5) Total Spare Parts needed for the CWS; 6) Total cherries received in 2015 (t); 7) and Average price per1kg of cherries. Ideally, we need other time invariant cooperative' characteristics (e.g., cooperative age) to improve the quality of the probability model.

As shown in Table 2, the probability model reveals that receiving the TAPI or TAP from other projects are associated with the probability of participating in TAPII, but the direction of the effect is different- negative for the TAPI and positive for the TAP from other projects. This finding demonstrates both the insufficient support that those cooperatives initially received from other projects as well as the objective of PRICE to build on the investment of other projects instead of starting from scratch. In addition, the CWS's total spare parts needed is positively associated with the probability of participating in TAPII, reflecting the fact that CWS' technical problems were one of the main criteria upon which the cooperatives were selected to receive the TAP.

Table A. 3: The Probability Model Used for The TAPII Matching

VARIABLES	(1) TAP=1
TAPI=1	-0.861**
	(0.392)
TAP from other projects=1	0.723*
	(0.386)
Capacity utilization rate of CWS (%)	-0.00901
	(0.00857)
Theoretical capacity of cherries (t)	-0.00594**
	(0.00259)
Total Spare Parts needed for the CWS	0.0567*
	(0.0290)
Cherries received in 2015 (t)	0.00290
	(0.00263)
Average price per1kg of cherries	-0.0193
	(0.0252)
Constant	3.765
	(3.872)
Observations	91

The kernel distributions of the propensity scores for both treated and control are shown in Figure 1. As is evident from the graph, there is almost full common support. The propensity score for the cooperatives that received the TAPII ranges from 0.1280 to 0.7608, whereas the corresponding range for the control cooperatives is from 0.0001 to 0.7702. As shown in Table 5, we have 16 counterfactual coffee cooperatives for our treatment group of the TAPII. The reason of ending up with less than 25 counterfactual cooperatives is that some cooperatives serve as a counterfactual more than once.

Figure A. 1: Kernel Density of Propensity Scores by Treatment Status

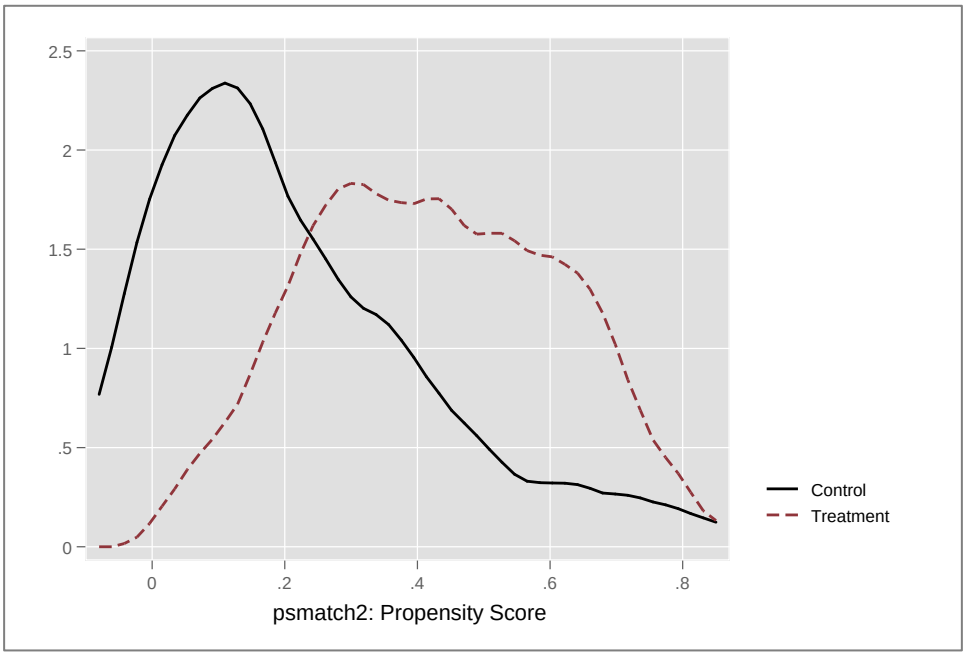
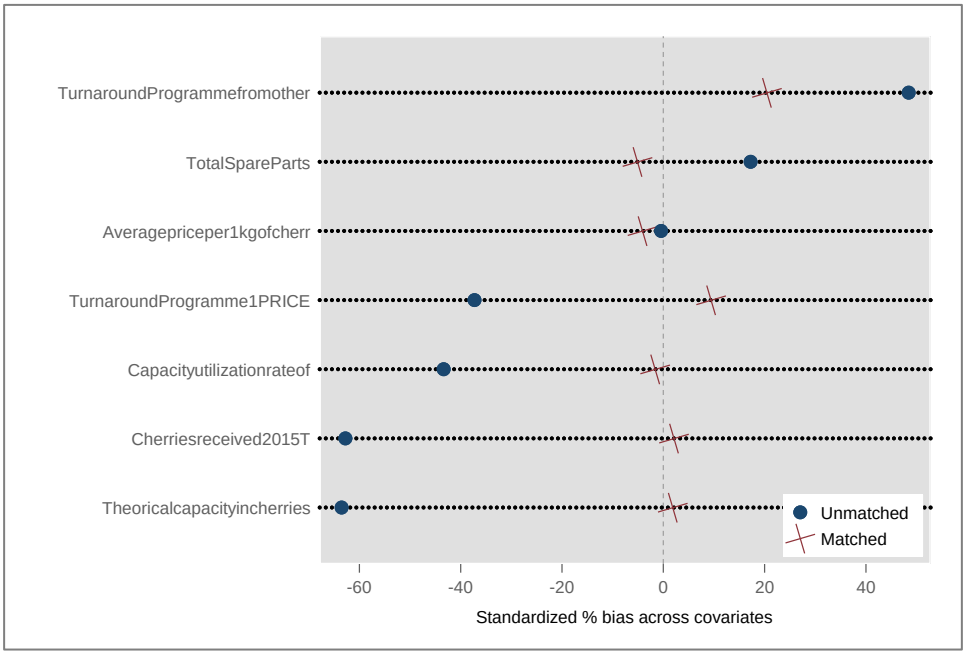


Figure A. 2: Standardized % of Bias across Covariates Before and After the Matching



Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.203	21.70	0.003	39.0	43.4	117.6*	0.32*	40
Matched	0.012	0.81	0.997	6.4	4.1	24.9	0.79	20

* if B>25%, R outside [0.5; 2]

Table A. 4: The Matching Results for the TAPII

Scores	Treatment						Control					
	_pscore	CWS	Coop	Province	District	Sector	_pscore	CWS	Coop	Province	District	Sector
0.1-	0.1280	Mizero coffee	Mizero coffee coop./Tech	South	Nyanza	Mukingo	0.1302	Bwishaza coffee	Bwishaza coop./C.Dormans Ltd	West	Rutsiro	Gihango
	0.1600	Mununu/Aburwagasabo	Aburwagasabo Coop.	East	Rwamagana	Fumbwe	0.1675	KOPAKAMA Nyagatare	KOPAKAMA Coop.	West	Rutsiro	Mushubati
	0.1674	Twongerekawa Coko	Twongerekawa Coop.	North	Gakenke	Coko	0.1961	Nyamirundi coffee. I	Nyamirundi coop./C.Dormans Ltd	West	Nyamasheke	Nyabitekeri
0.2-	0.2068	KOPAKABI	KOPAKABI coop.	East	Rwamagana	Karenge						
	0.2672	Nyarubaka CWS	Nyarubaka Coop.	South	Kamonyi	Nyarubaka	0.2687	Ruvumbu CWS/RTC	Abaryoshyakawa coop./Justin Musabyimana	West	Nyamasheke	Gihombo
	0.2938	Kageyo CWS/RTC	KODUKA Coop./RTC	West	Ngororero	Kageyo	0.2940	Cyingwa II/Gaseke	Tuzamurane coop./MICOF Ltd	West	Rusizi	Nyakabuye
0.3-	0.3090	Kibingo CWS	COPROCAGI Coop.	South	Gisagara	Nyanza	0.3105	Muhororo CWS	KOPIGUKA Coop./Ingoboka	West	Ngororero	Muhororo
	0.3093	KOGIMUWAKA	KOGIMUWAKA Coop.	South	Huye	Rusatira						
	0.3214	Abangakurushwa II	Abangakurushwa/C.Dormans Ltd	West	Nyamasheke	Ruharambuga	0.3269	Gishyita	Gishyita coffee coop/Tech	West	Karongi	Karongi
	0.3383	Kigembe coffee / RTC	Kigembe Coop	South	Gisagara	Kigembe	0.3366	Nkara/Dukundekawa II	Dukundekawa Coop.	North	Gakenke	Ruli
	0.3693	KOBAKANYA	KOBAKANYA /C.Dormans Ltd	West	Nyamasheke	Bushekeri	0.3653	Kayonza Coffee Coop. /RTC	KCC	East	Kayonza	Nyamirama
	0.3829	Karama coffee/RTC	Karama coffee coop./RTC	South	Kamonyi	Karama	0.3807	TURENGERIKAWA	Turengerikawa coop.	West	Rusizi	Nyakabuye
	0.3873	COOCAK Kigeyo	Coop.COOKAK	West	Rutsiro	Kigeyo						
0.4-	0.4108	Karora CWS/RTC	Karora coffee coop./RTC	West	Karongi	Mubuga	0.3962	Rukara CWS/Twongerumusaruro	Twongerumusaruro wa Kawa Coop.	East	Kayonza	Rukara
	0.4423	Matyazo coffee	Matyazo coffee coop./Tech	West	Ngororero	Matyazo	0.4320	Tuzamurubukungu coop	Tuzamurubukungu Coop.	East	Kirehe	Mpanga
0.5-	0.5301	COCATU /RTC	COCATU Coop./RTC	North	Rulindo	Tumba	0.5093	Gisiza CWS/COCAHU	COCAHU Coop.	East	Gatsibo	Kageyo
	0.5403	COCAMU CWS	COCAMU/Rusizi Spec. Coffee Ltd	West	Rutsiro	Musasa						
	0.5543	I.A.K.B/Ngoma/RTC	I.A.K.B Coop.	East	Ngoma	Murama	0.5775	Minazi/Abakundakawa	Abakundakawa Coop.	North	Gakenke	Minazi
	0.5780	Musambira/KOABAKA	KOABAKA Intarushwa Coop.	South	Kamonyi	Musambira						
	0.5785	Giseke coffee	KOAKAMBU	South	Ruhango	Mbuye						
	0.5856	COCUCAMU CWS	COCUCAMU Coop	East	Nyagatare	Mukama						
0.6-	0.6468	Nyagihanga coffee/RTC	Terimberemuhinzi wa kawa	East	Gatsibo	Nyagihanga	0.6404	Rusasa CWS	IKAWA YACU Coop.	North	Gakenke	Rusasa
	0.6486	Kinazi coffee/ARABICA	ARABICA Coop.	South	Ruhango	Ntongwe						
	0.6748	Muzo EER/COADECA	COADECA Coop.	North	Gakenke	Muzo						
0.7-	0.7608	Nyantinja CWS	COCAMUGI Coop.	South	Gisagara	Mukindo	0.7702	Ntenyo coffee	COCARU Abishyizehamwe coop	South	Ruhango	Ruhango

Our sampling size of 2600 of coffee farmers and we have 8 and 16 cooperatives serve as counterfactual groups for 50 cooperatives that represent the treatment groups of the TAPI and TAPII, respectively. Therefore, we will interview approximately 40 households within each cooperative. After we obtain a list of members for each coffee cooperative that owns a CWS we will randomize households for these interviews. Our selection process will ensure that we interview a representative sample of farmers within each cooperative. It worth mentioning that these results might be updated in case of receiving additional baseline data.

Appendix B: Matching Results for Horticulture Farmers

We present results that could include observations for our three proposed approaches aforementioned. Table 1 shows the number of applicants within both the treatment and control group according to different bandwidths. Treatment group represent those who got endorsed after passing the scoring selection criteria.

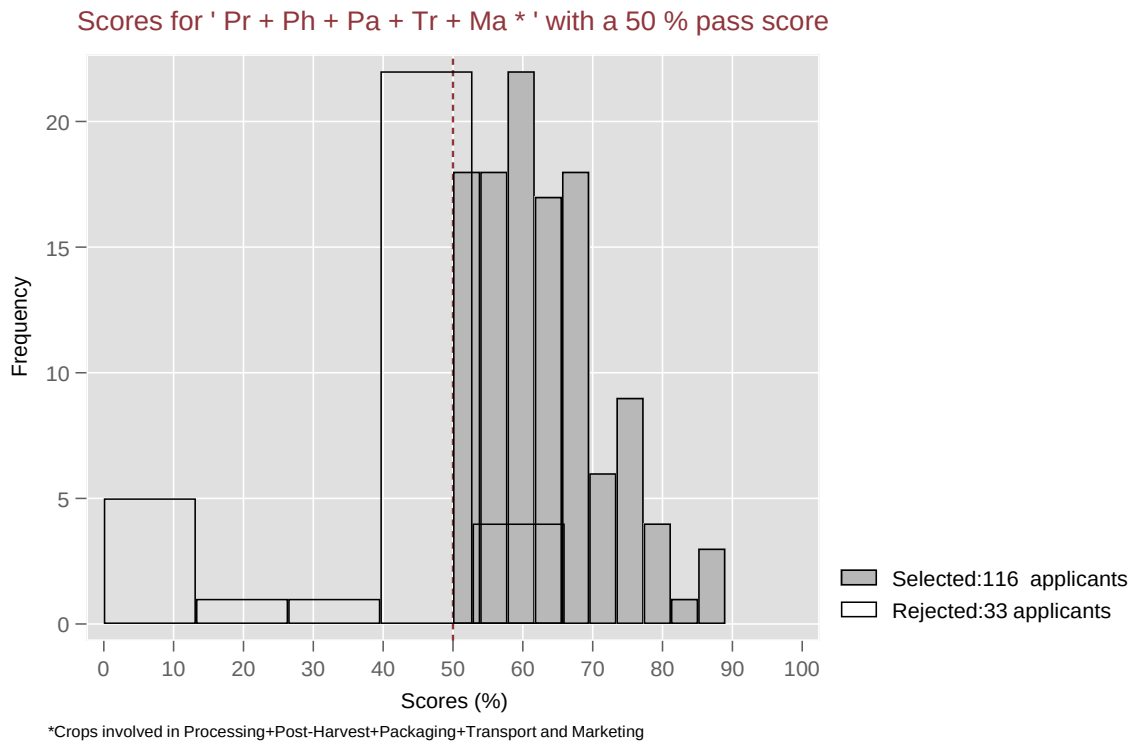
Table B. 1: Number of applicants within different bandwidths by treatment status

Bandwidth around the corresponding threshold	Number in the treatment group	Number of the control group
	All crops	
0.5 standard deviation	**99**	**1308**
1 standard deviation	**153**	**1796**
1.5 standard deviation	**261**	**2152**
2 standard deviation	**359**	**2227**
1. *All crops that involved processing, post-harvest, packaging, transport and marketing*		
0.5 standard deviation	73	3
1 standard deviation	99	24
1.5 standard deviation	111	27
2 standard deviation	114	27
2. *Essential Oils & Flowers (Primary Production)*		
0.5 standard deviation	26	1
1 standard deviation	45	7
1.5 standard deviation	53	14
2 standard deviation	57	20
3. *Onion (Primary Production)*		
0.5 standard deviation	0	103
1 standard deviation	9	192
1.5 standard deviation	47	224
2 standard deviation	58	244
4. *Passion fruit (Primary Production)*		
0.5 standard deviation	0	69
1 standard deviation	0	141
1.5 standard deviation	19	163
2 standard deviation	30	176
5. *Apple banana (Primary Production)*		
0.5 standard deviation	0	100
1 standard deviation	0	189
1.5 standard deviation	7	218
2 standard deviation	19	223
6. *Pineapple (Primary Production)*		
0.5 standard deviation	0	80
1 standard deviation	0	183
1.5 standard deviation	6	230
2 standard deviation	16	240
7. *Other Vegetables & Fruits (Primary Production)*		
0.5 standard deviation	0	568
1 standard deviation	0	1,060
1.5 standard deviation	18	1,276
2 standard deviation	65	1,297

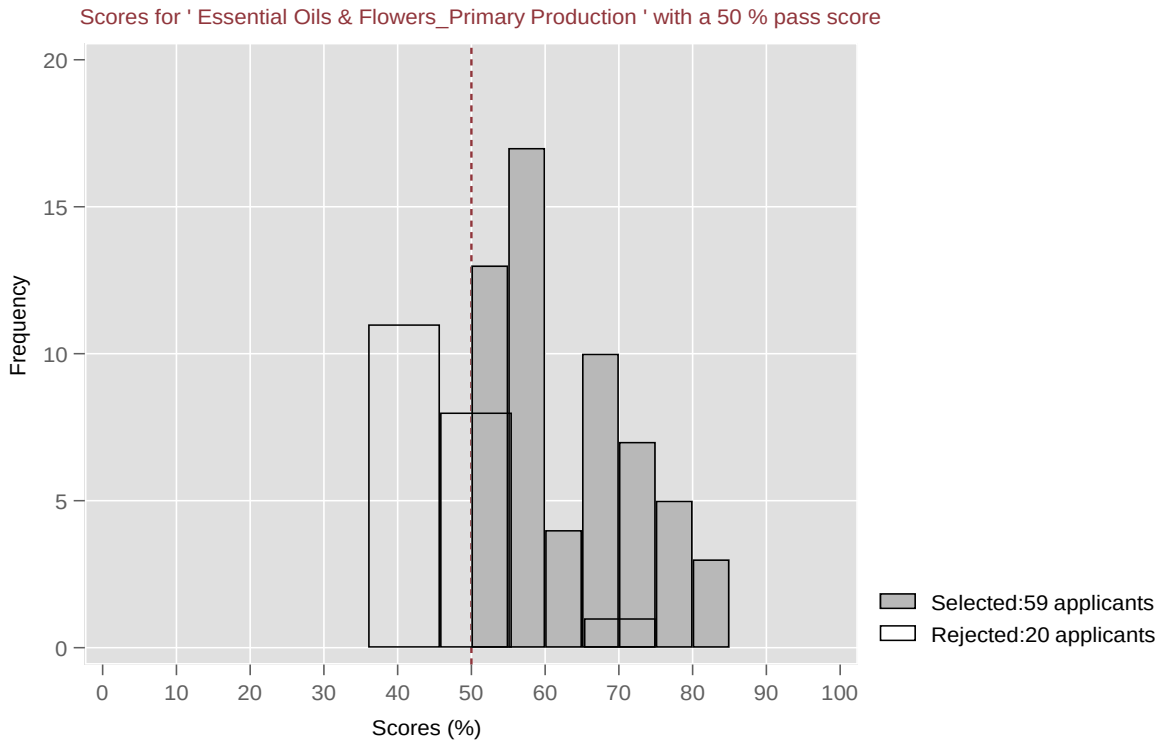
In our sample, we will include all 382 selected farmers who got an endorsement letter as well as rejected farmers who were 2 standard deviations for the first four crop types. For other crops, only those farmers within 0.5 standard deviation will be included given that we have few selected farmers as well as we can't include all of those who are within 2 standard deviations in these categories. Therefore, our tentative sample size is 1600 horticulture farmers.

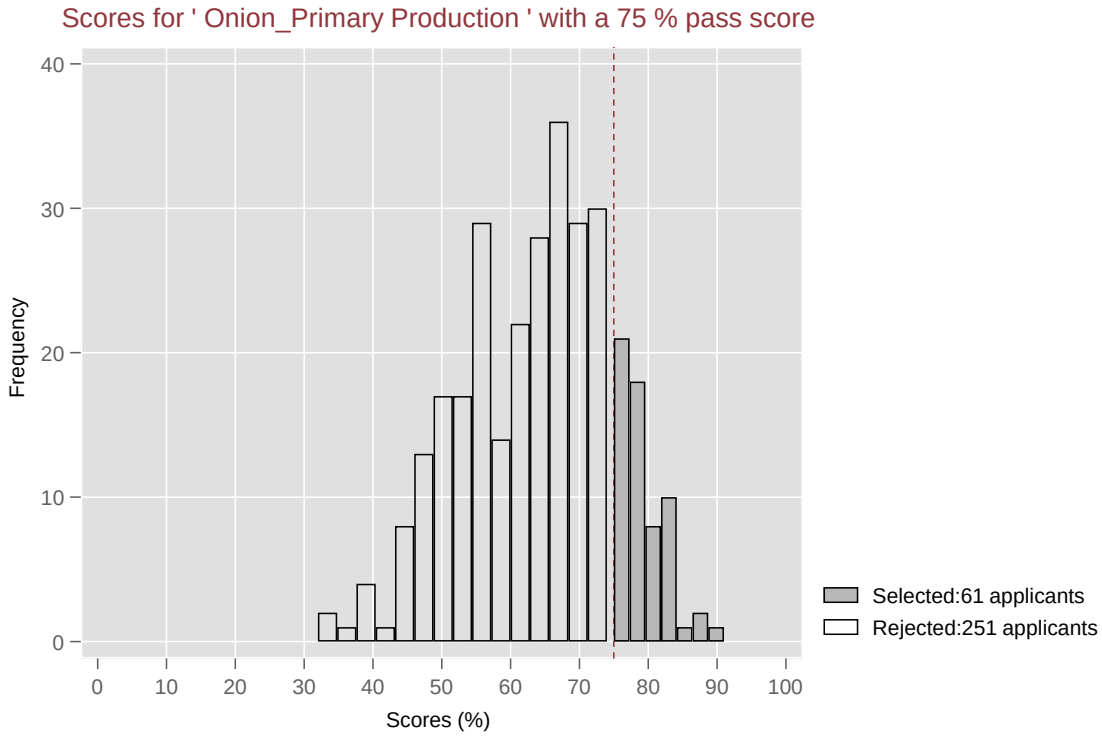
Figure B.1 shows the distributions of the applicants scores for each of the aforementioned horticulture crop types.

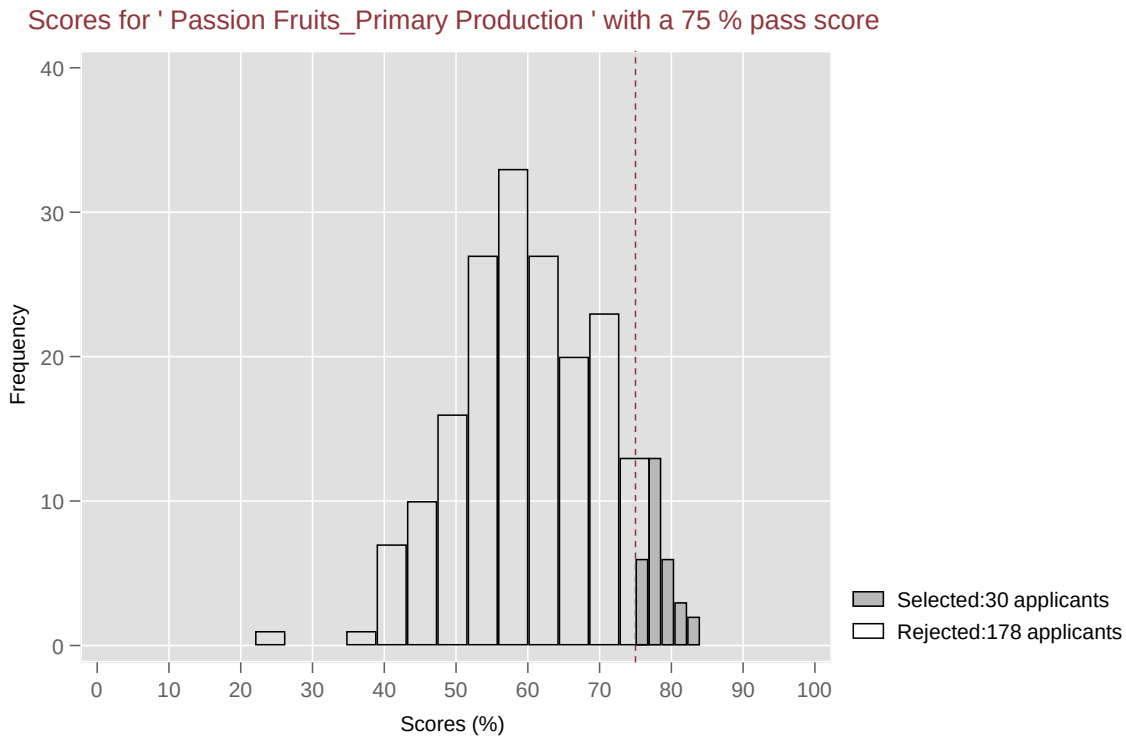
Figure B. 1: Distribution of the scores for different horticulture crop types

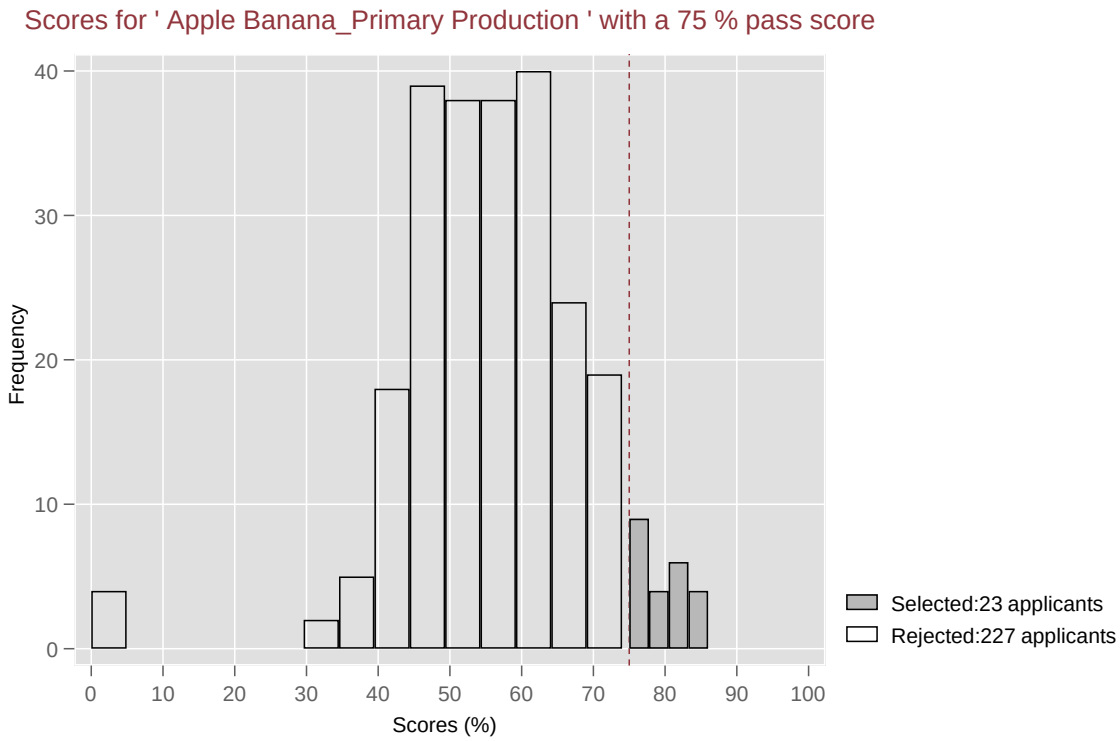


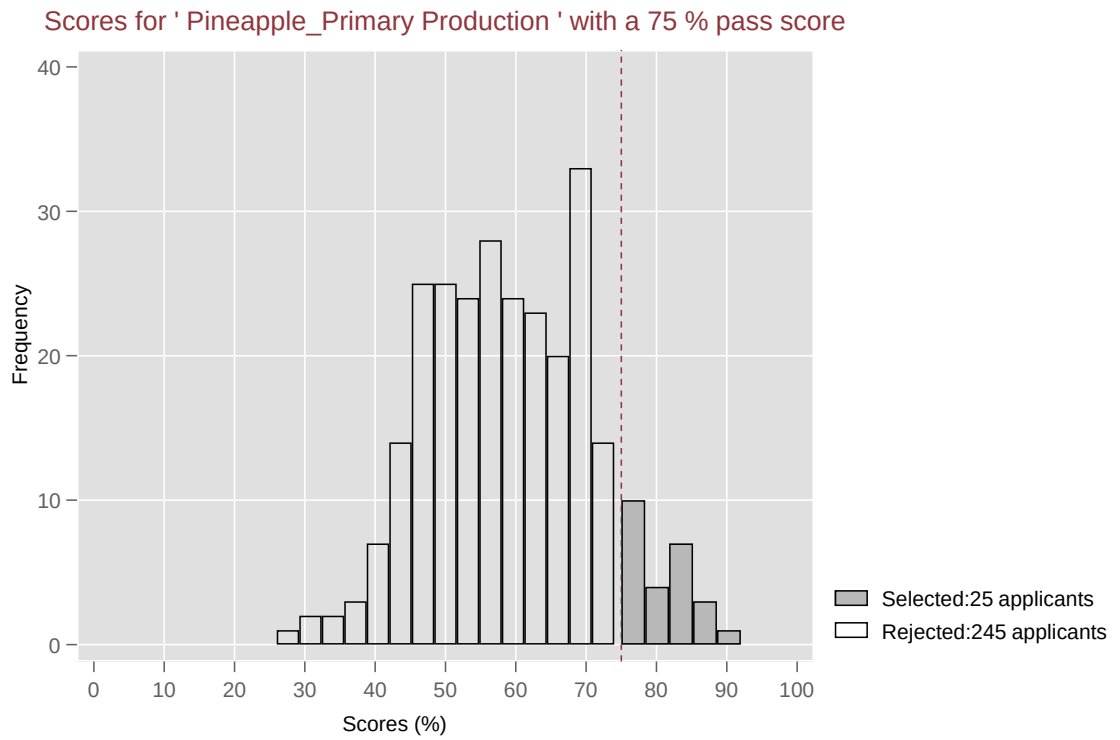
*Crops involved in Processing+Post-Harvest+Packaging+Transport and Marketing

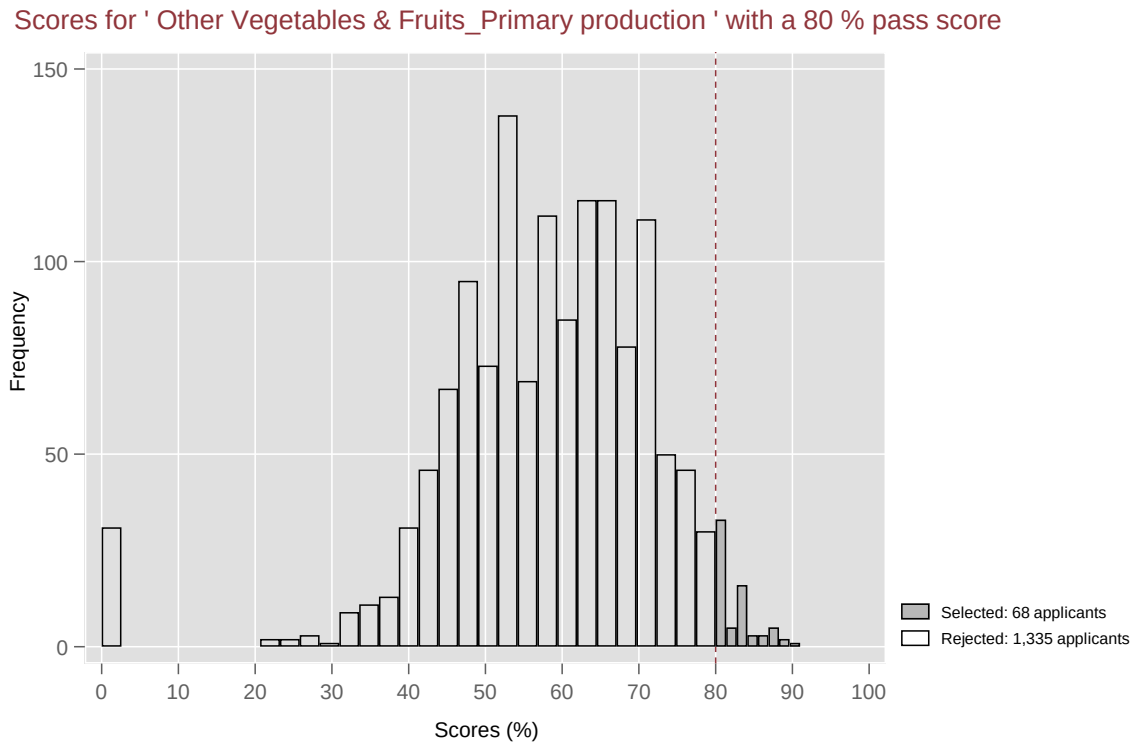



Scores for ' Onion_Primary Production ' with a 75 % pass score
Frequency
0
10
20
30
40
0
10
20
30
40
50
60
70
80
90
100
Scores (%)
Selected:61 applicants
Rejected:251 applicants


Scores for ' Passion Fruits_Primary Production ' with a 75 % pass score
Frequency
0
10
20
30
40
0
10
20
30
40
50
60
70
80
90
100
Scores (%)
Selected:30 applicants
Rejected:178 applicants


Scores for ' Apple Banana_Primary Production ' with a 75 % pass score
Frequency
0
10
20
30
40
0
10
20
30
40
50
60
70
80
90
100
Scores (%)
Selected:23 applicants
Rejected:227 applicants


Scores for ' Pineapple_Primary Production ' with a 75 % pass score
Frequency
0
10
20
30
40
0
10
20
30
40
50
60
70
80
90
100
Scores (%)
Selected:25 applicants
Rejected:245 applicants


Scores for ' Other Vegetables & Fruits_Primary production ' with a 80 % pass score
150
100
50
0
Frequency
0
10
20
30
40
50
60
70
80
90
100
Scores (%)
Selected: 68 applicants
Rejected: 1,335 applicants