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# Reaching out to socially distant trainees. Experimental evidence from variations on the standard farmer trainer system.

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# Reaching out to socially distant trainees. Experimental evidence from variations on the standard farmer trainer system.*

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**Abstract**

The farmer trainer (FT) model has gained momentum as a cost-effective alternative to traditional agricultural extension systems. However, there may be friction in the transmission of information, whereby farmers closer to the FT may benefit more than socially distant farmers. This study explores whether variations on the standard FT model facilitate the diffusion of information outside the FT's pre-existing social network. On top of a standard FT-training, a sub-sample of voluntary farmer trainers in rural Uganda was randomly assigned to receive either (i) vouchers for accessing professional extension agents, (ii) a signpost advertising the trainer services, or (iii) further training to learn to tailor training to trainee needs. The results show that the FTs assigned these treatment variations trained more farmers, a larger proportion of whom were in the FT's own close circle. The FTs who received vouchers, however, were the only ones to reach out to more socially distant farmers and were also those who gave the most training sessions. We show that these effects are independent of any FT prominence in the village. Nevertheless, further evidence suggests exercising caution regarding the presence of friction in the transmission of knowledge, since knowledge and technology adoption appear to increase only among farmers closely connected to the FT.

**Key words** : Farmer trainers, Agricultural extension service, Dairy farming, Social network, Sub-Saharan Africa, Uganda

**JEL codes** : O13, Q16

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# Introduction

Two-thirds of the world's poor live in rural areas and depend on agriculture. Sub-Saharan Africa ranks the lowest in terms of agricultural productivity, due mainly to a very low adoption rate of agricultural technologies compared to other developing countries.[1] Lack of access to information is one of the main market failures behind these low rates of technology adoption (De Janvry and Sadoulet (2019); Jack (2013)). Yet, the agricultural extension systems put in place to facilitate information diffusion often suffer from limitations, including logistical and financial constraints.

As an alternative, a farmer-to-farmer system has been in use in some countries for many years now.[2] Despite the wide adoption of this "farmer trainer" system (FT), few impact evaluations have been conducted to date (see Takahashi et al. (2020) for a review). Existing evidence documents low impacts on technology adoption when FTs act as volunteers and do not receive any incentives (Kondylis et al., 2017), whereas incentives based on social recognition appear to boost FTs' training efforts (Shikuku et al. (2019)) and FTs receiving pay-for-performance incentives are found to outperform professional extension agents in increasing farmers' knowledge and adoption of technologies (BenYishay and Mobarak, 2019). Yet, the farmer trainer system has come under criticism for sometimes cherry-picking prominent community members for reasons of cronyism and elite and political capture (Anderson and Feder (2004); Ragasa (2020)), thereby restricting information dissemination to a group of peers close to the FT.

This paper tests whether cost-effective variations on the standard FT-model increase participation in training sessions by farmers who are socially distant from the FT and whether the effect varies depending on the prominence of the FT's position in the village. In homophilous networks, FTs might prefer groups of trainees with homogeneous needs and capacities in order to limit the cost of training (Munshi (2004), Golub and Jackson (2012), BenYishay and Mobarak (2019)), thereby indirectly increasing the benefits of volunteering by strengthening social connections (Conley and Udry (2001); Munshi (2004); Fafchamps and Gubert (2007); Conley and Udry (2010)). Farmers close to the communicator are indeed found to be more likely to learn and adopt new technologies (Cole and Fernando (2021); Beaman et al. (2021)).

Socially-distant farmers might, then, end up excluded from these circles and from access to information. In Mali, Beaman and Dillon (2018) show that it is harder for those less socially connected, such as women, to access valuable information. In India, membership of different sub-castes and different family networks than the village supplier makes adoption much less likely (Emerick, 2014). These frictions in the diffusion of information may have undesirable

[1] Cultivation of modern varieties of maize represents just 17% of the total harvested area in Sub-Saharan Africa compared to 90% in East and South-East Asia and the Pacific (Jack, 2013). Fertilizer use is estimated at 10 kg/ha in Sub-Saharan Africa, as opposed to over 300 kg/ha in East Asia (FAO, 2017). In Uganda, recent estimates (Bold et al., 2017) show that only 7% of crop-growing households use some sort of fertilizer and 22% sow improved seeds.

[2] The system consists of training a local farmer in specific techniques that can be diffused to other farmers. Farmer trainers usually share similar characteristics with their fellow farmers, but have some features that make them good communicators. This system is deemed to have a number of advantages compared to traditional extension services: lower financial cost, local support from the farmer trainer and less farmer risk-aversion to adopting new technologies due to learning from a close peer.

social implications and may also be inefficient if marginal (poor) farmers undervalue information due to their inability to judge its value properly (Anderson and Feder, 2007). In this regard, Emerick (2014) finds that, not only is technology adoption within social networks much lower than adoption via door-to-door sales, but, most importantly, inefficiency due to less adoption within social networks is only marginally offset by a moderate improvement in targeting farmers with above-median expected returns.

Our analysis looks into the random assignment of three variations on the standard FT-model in addition to a farmer training program conducted in 627 villages in rural Eastern Uganda in 2015-2017. The basic treatment consisted of training local voluntary farmer trainers in animal feed and dairy farming practices for diffusion to their fellow farmers. In addition, three design variations were randomly assigned to treatment FTs: (i) vouchers for professional extension agents (Linkage variation), (ii) a metal sign-post serving as advertising and social signaling (Signpost variation), (iii) one additional day of training to teach FTs how to tailor their training content to farmers' needs (Needs Assessment variation).

This paper is the first to use rich monitoring data providing the full list of trainees at each training session given by treatment FTs over a two-year period. We combine these data with the list of dairy farmers in the baseline farmer trainers' agricultural network to explore whether FTs assigned to the treatment variations reach out to farmers more or less closely connected with them. Our analysis makes a novel contribution by exploring whether experimental variations on the standard FT-model differentially affect the diffusion of information within and outside the FTs' agricultural network.

We highlight three main sets of results. First, compared to FTs receiving the basic treatment, those assigned to the treatment variations trained more farmers, a larger proportion of whom were in the FT's close circle. These were mostly their own relatives and farmers with whom FTs shared dairy farming advice at baseline. However, the effects of the separate variations differ. FTs assigned to the Signpost and Needs Assessment variations trained a higher proportion of farmers closely connected with them, whereas FTs assigned to receive vouchers did not restrict information diffusion to farmers close to them and trained a higher share of more socially distant farmers. They also engaged more in training activities and reached out to a larger number of farmers overall.

Second, we explore whether design variations are equally effective depending on the FT's prominence at the village level. The debate is still on as to whether a vertical flow of information from lead to peer farmers is more effective than a horizontal flow from peer to peer and evidence about the best trainer's identity is still mixed. In this project, FTs were proposed by villagers at village meetings and then endorsed by the implementing partner, EADD.[3] Following Banerjee et al. (2014) and Banerjee et al. (2019), we use baseline information on FT characteristics in terms of "gossip" centrality, and also add information about geographic centrality and political position in the village to better proxy for FT prominence. Our results show that the three design variations do not substitute for (or complement) FT prominence. The distribution of

[3] Three main criteria applied to the selection of trainers: basic literacy, cattle ownership and lack of political responsibilities.

extension agent vouchers is not exclusively effective among prominent FTs, making it a feasible and cost-effective scheme under the farmer-to-farmer system without the need for (costly) FT targeting.

Third, we explore the mechanisms behind our main results and show that being backstopped by an extension agent makes FTs more accountable in the eyes of their trainees and helps FTs give training sessions. In a context where access to extension services is limited by monetary constraints on the demand side and scarcity of extension agents on the supply side, distributing vouchers to FTs facilitates access to extension and makes FTs better trainers.

Further evidence suggests, however, that knowledge transmission suffers from considerable frictions. We draw on survey data collected from a sample of farmers, wherein one randomly selected farmer and three farmers closely connected to the FT were sampled in each village. This sampling design enables us to explore the heterogeneous effects of treatment variations depending on the baseline connection between the sampled farmers and the FT. Results suggest that knowledge and technology adoption increased significantly only for farmers closely connected to the FT. These results point to persistent knowledge transmission along social network lines, in line with Emerick (2014).

This paper stands at the intersection between the literature studying the patterns of information diffusion in an agricultural setting and the literature on mobilizing agents to engage for the community's benefit. It contributes to both strands of literature by exploring how alternative ways of shaping trainers' activities could help reach out to trainees who are socially distant from the communicator.

The first main strand of literature to which this paper relates concerns the role of farmers' social networks in the diffusion and adoption of new practices (Conley and Udry (2001); Fafchamps and Gubert (2007); Munshi (2004); Bandiera and Rasul (2006); Conley and Udry (2010); Vasilaky (2013); Krishnan and Patnam (2014); Maertens (2017); Mekonnen et al. (2018); Campenhout (2021)). Recent literature stresses the importance of the communicator's position in the village social network and the type of social connection with the other farmers (Banerjee et al. (2013); Emerick (2014); Banerjee et al. (2014); Maertens (2017); Beaman and Dillon (2018); Banerjee et al. (2019); BenYishay and Mobarak (2019); Lee et al. (2019); Takahashi et al. (2019); Shikuku (2019); Shikuku and Melesse (2020); Cole and Fernando (2021); Beaman et al. (2021)). Using detailed monitoring data matched with social network data, we provide new evidence to show that relatively simple and cost-effective variations of the standard farmer-to-farmer model can help reach out to less socially connected farmers. Moreover, we provide suggestive evidence that these variations are effective independently of the farmer trainer's social position in the village.

Second, this paper contributes to improving the design of farmer trainer systems, by providing new evidence on the effectiveness of different design variations. Existing evidence is scarce and more work is needed to assess the impacts of the farmer trainer programs and improve their system design (Davis et al., 2019).

Our work also more broadly relates to studies on the best ways of galvanizing agents to voluntarily engage in collective activities. Most of the literature focuses on the effects of monetary versus non-monetary compensation, the effectiveness of which is strongly connected with the motivation behind an agent's engagement, either intrinsic or extrinsic. Existing evidence shows, for instance, that monetary compensation can backfire when an agent's intrinsic motivation dominates (Frey and Oberholzer-Gee (1997); Gneezy et al. (2011);Deci and Ryan (2013); Chetty et al. (2014)). This topic is of interest above and beyond the dissemination of agricultural technologies. The issue of designing the right agent motivation mechanisms is also a prime concern when it comes to motivating workers in firms (Besley and Ghatak (2005); Besley and Ghatak (2016)) and to improving the efficacy of health-related interventions (Ashraf et al. (2014a); Ashraf et al. (2014b); Deserranno (2014)). We contribute to this literature by showing that agents can be effectively galvanized to voluntarily engage in collective activities with cost-effective strategies easily usable in a constrained-resource context.

As a final note, we would like to emphasize that the contribution of this study complements the findings of the companion paper by Behagel et al. (2020). Our study differs in terms of research question, data sources and sample. We explore whether variations on the standard farmer-to-farmer system design attract farmers from outside a close group of peers and whether the effectiveness of the variations depends on the FT's prominence in the village. This adds upon the companion paper analysis of the general program impact on dairy farming conducted with survey data. Moreover, our analysis is based on monitoring data merged with the FT's agricultural network data, whereas survey data are used only for secondary analysis.[4] We believe that our analysis provides a distinct and innovative contribution to the existing literature, looking at so far unexplored effects of an FT-program beyond a "standard" impact evaluation analysis.

The remainder of this paper is organized as follows. Section 1 describes the project intervention and the variations on the standard FT model central to the experiment. Section 2 presents the sample design and data sources. Section 3 discusses the main characteristics of the farmer trainers and sampled farmers. Section 4 describes the main outcomes and empirical strategy. Section 5 presents the main findings and mechanisms. Section 6 we discusses suggestive evidence from our secondary results. Section 7 presents the robustness checks and the last section presents our main conclusions.

# 1 The project intervention

The East Africa Dairy Development Project (EADD) is designed to help smallholder dairy farmers in rural areas of East African countries to increase their milk production and sales via the use of technology.[5] In this program, dairy farming technology is represented by highly nutritious

[4] In this respect, it is worth mentioning that one of the authors was part of the research team and designed the present study before the baseline data collection was carried out, including the design of the data collection tools (in particular the FT's agricultural network module and the attendance sheet forms) in order to conduct the present analysis.

[5] The EADD project is a joint initiative led by Heifer International, TechnoServe, ABS, ILRI (the International Livestock Research Institute), and ICRAF (the World Agroforestry Center), financed by the Bill and Melinda Gates Foundation.

feed (mostly to be grown on the farm) and special feeding practices to improve cows' health and milk production.[6] For this purpose, an extension program based on a farmer-to-farmer model was conducted in rural Eastern Uganda between spring 2015 and fall 2017.

In Uganda, agricultural extension has been provided by the National Agricultural Advisory Services (NAADS) since 2001. NAADS facilitates decentralized public-private extension service delivery by promoting the development of farmer organizations using extension services. The context is one of a limited supply with a large, heterogeneous, dispersed demand which is costly to reach. Few farmers have access to extension services, and most of those who do are large-scale farmers with the ability to pay for them and adopt innovations. As these farmers differ from the average farming population, farmer-to-farmer diffusion is limited.

## 1.1 Selection of farmer trainers and randomization design

From December 2014 to June 2015 village meetings were held in each of the 627 sampled villages in the districts of Kamuli and Buyende in Eastern Uganda to identify eligible candidates to the training program. Village representatives were informed about the project by the EADD staff and agreed on the following criteria to select one FT per village: (i) primary school completion, (ii) ownership of at least one head of cattle and (iii) no political responsibilities. The selection process excluded extension agents and community leaders to prevent cherry-picking of the most prominent community members while promoting a community-based and participatory process.

The village representatives held village meetings at which two to three candidates were identified. These were then interviewed by EADD project staff, who selected one potential farmer trainer (FT) per village to be placed in the lottery for the random assignment of the training program. We call these "potential FTs" as they were identified in all sample villages, prior to the lottery. We subsequently call potential FTs "shadow FTs" in the control group villages.

Two-thirds of potential FTs were randomly drawn to be given a one-week training course on cattle-management techniques and feeding practices in dairy production. Seedlings and pasture seeds were also distributed to training participants free of charge. In addition to this basic initial training, a two-day "refresher training" course was provided twice a year.

In the control villages, the shadow FTs received training three years later. Farmer trainers living in villages assigned to the treatment group were then expected to hold training sessions to diffuse the practices learned to the other farmers in their villages. The EADD project provided no in-kind or monetary compensation to the FTs for their training activities.

Randomization was based on public lotteries. Two sets of lotteries were conducted, one to allocate villages to the treatment group and the other to assign treatment variations. The lotteries were clustered at the parish level and held in central places to facilitate farmer attendance.

[6] FTs were trained in planting grasses (e.g. elephant grass, caliandra, Rhodes grass, etc.) and improving pastureland (weeding, bush clearing, paddocking, etc.). They were also taught about feeding technologies, such as hay and silage making, water harvesting, crops residue management and feed conservation.

A total of 11 separate public lotteries took place, six of which were stratified in two strata based on the baseline FTs' number of cows owned.

## 1.2 Variations on the standard FT model

In addition to the main treatment, three variations were further randomized to encourage voluntary engagement by FTs. Each treatment variation was assigned independently of the others. Each FT could be assigned to zero, one, two or three variations.

**Linkage variation.** The first treatment variation consisted of giving FTs twelve vouchers to pay for professional extension agents (EAs) to visit their farm and cattle once a month. During their visits, extension agents can also provide technical support, additional training and assistance with the training sessions and could monitor the FT's training activities.

Vouchers are a way to make access to extension services more affordable, by relaxing the farmer trainer's budgetary constraint. This is expected to increase the quality and quantity of training sessions for a number of reasons. The EA may provide further information and demonstrate practical applications, hence improving the FT's knowledge and use of the techniques. FTs might then be able to teach a wider range of topics to a broader spectrum of farmers. This would increase the quality of training and potentially the number of sessions and trainees, attracting farmers more socially distant from the FT.

Moreover, the presence of an EA at training sessions could act as a "pull factor", increasing farmers' expected benefits from the training. Anecdotal evidence indeed suggests that FTs who receive regular EA visits are deemed more credible by village farmers. The presence of an EA at training sessions is therefore likely to attract a greater number and variety of farmers. Nevertheless, EA attendance at training sessions remains marginal in this program, as most of the sessions were set up by the FTs alone.

Voucher distribution may also free up monetary resources for farmer trainers to increase adoption of dairy techniques. This would make the FT familiar with a wider range of dairy techniques, possibly improving the quality of training.

**Sign-post variation.** The second variation consisted of placing a metal signpost outside the FT's residence displaying a picture of a healthy crossbred cow, and the FT's name and telephone number. FTs were also free to add information about the training sessions, such as the number of farmers attending training in the last month, the number of sessions held and the number of feed technologies applied by the trainees and the FT.

This intervention was designed to act on the supply side only, without directly contributing to the quality of the training sessions. It was expected to increase the FT's social status and to attract a greater number and variety of farmers. In line with Ashraf et al. (2014a) and Shikuku et al. (2019), the signpost can be a signal of social recognition, imparting a reputation effect and indirectly stimulating FTs' efforts in terms of the quantity and quality of training sessions. Given that the sign-post intervention does not directly improve the quality of training, FTs assigned to this mechanism are not any more knowledgeable than those in the basic treatment group or those assigned to the other variations. Whether farmers expect higher benefits from training will depend almost exclusively on the change in perceptions brought about by the sign-post. Anecdotal evidence suggests, however, that the signpost could also backfire as farmers might suspect that the FT is paid to hold training sessions, whereas the EADD program promotes *voluntary* farmer trainers.

**Needs Assessment variation.** FTs assigned to this variation received one extra day of training every six months to learn how to conduct Needs Assessment sessions. They were instructed to tailor the type of techniques taught to the production profiles of their trainees and were provided work plan forms to design customized action plan to facilitate farmers adoption of dairy technologies.

Targeting technology adoption by addressing farmers' specific needs and constraints is expected to improve training quality, and to encourage farmer participation and technology adoption. This could, however, come at the expense of setting up training sessions with small groups of farmers, potentially fairly homogeneous, thereby limiting the diffusion of information to farmers closely connected with the FT.

It is important to note that the EADD FT program represents a cost-effective model of agricultural extension. The cost of the basic treatment amounted at $110 per FT per year.[7] The Linkage and Signpost variations each cost $25 per village per year, which is less than organizing monthly EA visits. The Need Assessment variation was the most expensive at $47 per village per year, due to the extra training-day and the materials provided to the FTs. The overall cost of this program remains cheaper than a basic agricultural extension service that has to pay for the EA's transport, accommodation and salary. From a planner's perspective, analyzing the effect of this intervention can help ease the financial and logistical constraints that hamper the operationalization of information dissemination policies.

# 2 Data

## 2.1 Sample design

The initial sample is comprised of 627 villages. In each village five farmers were polled at the baseline, midline and endline surveys: the FT, three farmers selected from the FT's agricultural network and one farmer randomly selected from the other dairy farmers in the village.

The baseline survey was conducted between January and June 2015. The midline and endline survey data were collected, respectively, in July-September 2016 and July-September

[7] Details on the cost of the program can be found in Behagel et al. (2020).

2017. Attrition between the baseline and endline survey was law with an overall response rate of 98.2%.[8]

## 2.2 FT agricultural network data

At baseline, FTs were asked to name up to 22 farmers they know in different social network dimensions deemed relevant to the diffusion of dairy farming information (close neighbors, dairy farmers with whom the FT shared dairy farming advice, farmers who could be depended on in times of need, farmers they usually talked to at church/mosque - see Appendix A.1 for the complete list of questions). FTs were allowed to name the same person in different dimensions. The maximum number of connections was set at 22 dairy farmers so as to focus on the closest connections.[9] The focus of this analysis on the FT's first-degree contacts was justified by our interest in the diffusion of information to farmers with close connections with the, whereas we did not aim at mapping the entire FT's social network.

Despite the opportunity of listing up to 22 names, our data report that the median (and average) number of connections reported by FTs was almost 11, suggesting that, even if the number of possible connections was top-coded, this did not impede FTs from listing all relevant links. FTs who did not give the full 22 names had most likely exhausted the mapping of their first-order agricultural social connections.[10]

To provide further insights about the characteristics of the FT's social connections, the baseline questionnaire then collected detailed information on the relationship between the FT and nine of the (maximum) 22 farmers initially named by the FT.[11] The list of nine farmers was made by the three sampled ones, plus three farmers among the neighbors and three randomly selected from the other social network dimensions. In addition, two more farmers were added, randomly picked from the list of village dairy farmers provided by the village chief (excluding those already named by the FT). Detailed information was hence collected on the relationship between the FT and these eleven farmers (kinship, frequency of contact, etc.), nine of which were among the FT's 22 first-degree contacts.

The questionnaire administered to the four sampled farmers included a social network section already filled out with the FT's name, the names of the other three sampled farmers, and the names of the others on the list of eleven farmers.[12] All four sampled farmers were asked about their relationship with the FT and the other three farmers in the baseline survey.

[8] Response rates were as follows: 96.8% for control FTs (13 non-respondents), 96.8% for treated FTs (7 non-respondents), 98.3% for control farmers (28 non-respondents), and 99.2% for treatment farmers (7 non-respondents).

[9] The number of 22 was not chosen ad hoc, but is the result of a list of five neighbors plus five farmers who recently asked the FT for dairy farming advice, plus two names for each of six social dimensions (see Appendix A.1).

[10] We acknowledge that the relatively low number of connections could also be due to memory load and incompleteness of social dimensions presented in the questionnaire.

[11] The decision to collect detailed information on eleven contacts only was driven by the average number of farmers named by the FT in the first place. Budget constraints ruled out the possibility of collecting detailed information on the full list of 22 names and of surveying all 11 farmers in each of the 627 sampled villages.

[12] The questionnaire did not specify which farmer was the farmer trainer. Sampled farmers were simply given a list of dairy farmers living in the same village, on which the name of the farmer trainer appeared.

Table 1 summarizes the procedure used to select the sampled farmers from of the FT's list of 22 farmers. One of the dimensions listed in the agricultural network module asked for the dairy farmers who recently sought advice from the FT on dairy farming. Among those named by the FT, three were randomly selected to be sampled. In addition, one dairy farmer was randomly selected from the list of village dairy farmers provided by the village chief, first excluding those already named by the FT. Both types of farmers are statistically similar on average (see Table A2).

Table 1: FT agricultural connections and sample of farmers

| **Agricultural connections** | **Detailed information** | **Four sampled farmers** |
|---|---|---|
| List max. 22 farmers (*first-degree connections*) | Sub-sample of 11 farmers | Baseline, midline and endline surveys |
| 1. Asked for FT's advice (up to 5) | → Select 3 | → Same three (*close circle*) |
| 2. Neighbors (up to 5) | → Select 3 | / |
| 3. Six social dimensions (up to 12) | → Select 3 | / |
| / | + 2 random farmers | → Select 1 |

## 2.3 Attendance sheets

To build our main outcome variables, we cross the agricultural network data with monitoring data collected by FTs during training sessions. FTs in the treatment group had to fill out an attendance sheet for each session containing session date, trainee names and surnames, and trainee signatures. We used these data to measure the main outcomes of interest relating to the FT's training activities.

Over the two years of the program, 82% of FTs in the basic treatment group gave at least one training session (Table A3) for an average of five training sessions and some 22 farmers trained. These numbers were higher for FTs assigned to the treatment variations. In particular, FTs assigned to the Linkage variation were more active than those assigned to the other two treatment arms. Linkage FTs gave an average of 13 sessions (compared to 11 in the other two groups) and trained 43 farmers (against 37 for Needs Assessment and 41 for the Sign-post group). Finally, training sessions given by FTs in the basic treatment group appeared to attract slightly more attendees than those in villages assigned to the design variations (6.4 trainees per session compared to 5.8 for the variations).

FTs gave training sessions throughout the duration of the program, even though a higher number of sessions were held in the last trimester of 2015 and the first trimester of 2016. This period corresponds to the wet season when farmers have less farm work and more time to host or attend training sessions.

We matched the attendance sheet data with the baseline FT network data based on farmers' names and villages of residence to identify the connection between trainees and FTs at baseline (see section A.2 for more details on the matching protocol). Three categories of trainees can hence be identified:

1. First-degree sampled farmers
2. First-degree contacts
3. The remaining trainees, considered as higher-degree contacts

First-degree sampled farmers are the three sampled farmers - named by the FT in the agricultural network module as having sought dairy farming advice from him in the past thirty days - also found on the attendance sheets.These represent what we call the FT's "close circle". First-degree contacts include all those farmers named by the FT in the network module and are also found on the attendance sheets. We distinguish these two groups from the rest of the trainees who are listed on the attendance sheets, but not in the FT's network module. They might be known by the FT (we cannot check this information against our data), but, given their absence from the FT's agricultural network list, we considered them to be either higher-degree contacts or previously unknown to the FT.

We used these categories to measure three main outcomes: (i) the share of trainees in the close circle, i.e. the number of first-degree sampled farmers appearing on the attendance sheets divided by the number of the FT's first-degree sampled farmers; (ii) the share of trainees among the first-degree contacts, i.e. the number of first-degree farmers listed in the FT's social network at baseline and appearing on the attendance sheets divided by the number of first-degree farmers listed in the FT's social network and (iii) the share of trainees who are not first-degree connections of the FT, i.e. the number of farmers appearing on the attendance sheets but not in the FT's social network, divided by the number of trainees in the attendance sheets at the FT-level. It is important to highlight that this analysis relies on FT's agricultural network data to build outcome variables by distinguishing two types of trainees - whether previously part of the FT's close circle or not. We do not regress economic outcomes on agricultural network characteristics, as usually done by the social network literature, hence the usual worrying biases arising from incomplete network data do not apply here (Chandrasekhar and Lewis, 2011).

Descriptive statistics reported in Table A3 show that roughly half of the sampled farmers appeared as trainees on the attendance sheets, indicating that the sampling procedure was successful in identifying future trainees. The share of trainees among FT first-degree connections represented 14-16% of all the trainees listed on the attendance sheets, with the remainder from outside the FT's close social network.[13]

These figures already suggest that the diffusion of information was probably not limited to the FT's close circle of peers. The share of trainees who were not first-order connections is large, possibly indicating a wider diffusion especially in the Linkage variation.

[13] These descriptive statistics concern the full sample of FTs. There are 30 FTs in the treatment group who never trained farmers and who are, nevertheless, included in the regression analysis. If we exclude these ones, the sum of the share of first-degree and higher-degree trainees is equal to one.

# 3 Descriptive statistics

This section provides some descriptive statistics on socio-demographic characteristics and aspects of dairy farming measured at baseline for farmer trainers and sampled farmers. We also provide balance checks of observable characteristics between farmers in the basic treatment group and in the treatment variations.

The baseline sample is comprised of 3,127 individuals, including 627 farmer trainers and 2,500 sampled farmers. Of the 627 FTs, 216 were assigned to the control group and 411 to the treatment group. As explained above, a treatment FT could be assigned to more than one variation. Table A4 shows that 50 FTs were assigned to the basic treatment group (training only), 162 were assigned to one variation, 146 to two variations and 53 to three variations.[14] Roughly the same number of FTs were assigned to each variation. Our analysis focuses only on farmers and FTs in the treatment group.

## 3.1 Farmer trainers

Table 2 presents the summary statistics for FT baseline characteristics and provides the balance check between the treatment variations and the basic treatment group. The characteristics of FTs assigned to either group are balanced, with a slight imbalance in terms of the number of dairy technologies used and social network size. For both variables the sample mean is slightly higher for FTs in the basic treatment group.[15] In the Appendix we show that our results are robust to controlling for these variables.

The figures reported in Table 2 show that most FT household heads are men (9 out of 10), aged 42 years old and have almost all attended school.[16] Around 36% of FT household members are/were already actively engaged in their communities as members of a local committee. FTs are not very often identified as the most successful dairy farmer or the closest neighbor in the village by the other sampled farmers (between 18% and 22%). If we account for these three variables together, about 84-86% of FTs fall into one of these categories at least with an average of 1.4 categories out of three (see below).

The baseline knowledge level of dairy practices is fair, although self-reported adoption is quite low. Out of 26 dairy technologies (12 practices and 14 animal feed), FTs know an average of 18 technologies, nine of which concern animal feed. Adoption is even lower. They apply an average of nine dairy technologies, five of which are animal feed.

Few other characteristics are of note. Farmer trainers own an average of six heads of cattle, two of which are dairy cows. Access to savings and credit services is fairly common (72% and 52% respectively), suggesting that monetary constraints should not be a major barrier to technology

[14] The study was not designed to have enough statistical power to evaluate the impact of the variations' interactions (Behagel et al., 2020), although we provide a robustness check of the main results controlling for the double and triple interactions (Table A13).

[15] The balance check comparing the pure control group with the treatment group finds similar results (see Table A1).

[16] FTs are almost all men (95%).

adoption in this setting. Farmer trainers had no trouble answering the social network module and we have detailed information for 10.9 social connections on average.

### 3.1.1 Farmer trainer prominence

In the standard farmer-to-farmer system, extension agents cannot directly train all possible FTs, due to budgetary constraints and limited logistical capacities. The selection of the "right" farmer trainers to be trained by extension agents in order to diffuse information is, therefore, crucial. We explore here whether the design variations are more or less effective when the FT holds a prominent role in the village.

We rely on the baseline data to measure FT prominence, by combining three different variables. We consider whether sampled farmers identify the FT as one of the three most successful dairy farmers in the village or one of the three closest neighbors, in keeping with Banerjee et al. (2019). In addition, we account for whether at least one member in the FT's household holds a political role in the village at baseline. We create two measures of FT prominence: a dummy equal to one if at least one of the three dimensions (successful farmer, neighbor and political position) is confirmed and a categorical variable ranging between 0 and 3 for the total number of categories verified.

We investigate the complementarity between these measures of FT prominence and the three design variations. This can have considerable implications for FT targeting, revealing whether prominent FTs attract more and a wider range of trainees, diffusing information beyond their close social network, or whether FTs similar to the average village farmer are more effective.

Descriptive statistics reported in Table A5 show that less than one farmer per village in the basic treatment group considers the FT to be the most successful farmer in the village or name the FT as one of the geographically closest farmers. On average, 20% of sampled farmers named the FT as the most successful or geographically closest dairy farmer in the village. Around 52% of the FTs were identified as the most successful, 55% as the geographically closest farmer in the village by at least one farmer and around 36% of FTs lived in households where at least one member (including the FT) held at baseline or in the recent past a political position at the village/parish/district level.

## 3.2 Sampled farmers

Table 3 shows that the characteristics of sampled farmers in the basic treatment group and the variations group are balanced along a set of observable characteristics. We only find a slight imbalance in terms of the likelihood of using a savings institution.

The majority of the sampled farmers' household heads (9 out of 10) are men aged 46 years with basic literacy. Access to savings and credit services is fairly widespread although it is less common than among farmer trainers (56% in the basic treatment group).

The sampled farmers' dairy activity is fairly similar to that of the farmer trainers presented above. Sampled farmers own an average six heads of cattle, two of which are cows. Roughly

83% of farmers produced milk in the past 12 months, for an average of almost 3 liters per day. Yet only some 40% of them sold any milk in the last wet season.

By contrast, knowledge and adoption of dairy technologies is slightly lower among farmers than farmer trainers. Out of 26 dairy practices and feed sampled farmers know an average of 15 technologies, half of which concern animal feed, but apply less than seven of those technologies, roughly half of which concern animal feed.

### 3.3 Farmer trainers and sampled farmers

We expect farmer trainers to differ from sampled farmers in view of the farmer trainer selection process. To compare these two groups, we pool the basic treatment group and the variations group. The tests on the differences of the means reported in Table 4 show that sampled farmers and FTs are indeed significantly different in terms of a number of household characteristics, milk production, knowledge and adoption of dairy technologies measured at baseline.

Prior to the beginning of the program, FTs had a higher level of knowledge and adoption of dairy technologies, as well as higher milk productivity than sampled farmers. For the same average number of cows, FTs reported a higher average level of milk production per day (0.87 liters more). This suggests higher productivity for FTs, possibly related to the slightly higher level of knowledge and adoption of dairy practices and feed. FTs know and use an average of one more feed practice and 2 more technologies than sampled farmers.

FTs appear to have a slightly higher standard of living. Sampled farmers live in larger households where the household head is older than in FT households and they have a lower level of literacy. In addition, FTs are 10 percentage points more likely to access savings institutions and 7 percentage points more likely to borrow money than sampled farmers.

## 4 Empirical strategy

The main aim of this study is to explore whether variations on the standard farmer-to-farmer system design attract farmers from outside a close group of peers and whether the effectiveness of the variations depends on the FT's prominence in the village. Our main outcomes of interest focus on the FTs' training activities and, in particular, on the type of farmers who attend the training sessions.

This analysis assesses the intention-to-treat effect of being assigned to one of the three treatment variations compared to being assigned to the basic treatment. This corresponds to a standard farmer-to-farmer scheme and hence constitutes a relevant counterfactual. The sample for our analysis is restricted to FTs assigned to the treatment group.

We compare the effect of the three treatment variations combined or one by one ($T_{js} = 1$)

against the basic treatment group ($T_{js} = 0$), by estimating the following linear regression:

$$Y_{js} = \alpha + \beta T_{js} + \lambda_s + \epsilon_{js} \tag{1}$$

Where $Y_{js}$ is the outcome for FTs living in village $j$ in lottery stratum $s$. The lottery strata fixed effects are captured by $\lambda_s$. Lotteries were stratified at the parish level to compare individuals assigned to the control group and the four treatment groups in the same parish. The error terms ($\epsilon_{js}$) are clustered at the village level and are robust to heteroskedasticity.

To investigate the complementarity between the three treatment variations and the FT's prominent role in the village, we interact each treatment variation with our proxy for FT prominence ($C_{js}$) and estimate the following regressions:

$$Y_{js} = \alpha + \phi T_{js} * C_{js} + \gamma T_{js} + \delta C_{js} + \lambda_s + \epsilon_{js} \tag{2}$$

The last part of our analysis draws on the self-reported survey data by sampled farmers ($i$) in the treatment group and exploits the sampling design by comparing farmers previously connected to the FT to farmers randomly picked from the village list ($R_{ijs}$). The specification as follows:

$$Y_{ijs} = \alpha + \phi T_{js} * R_{ijs} + \gamma T_{js} + \mu R_{ijs} + \lambda_s + \epsilon_{ijs} \tag{3}$$

The error terms ($\epsilon_{ijs}$) are clustered at the village level and are robust to heteroskedasticity.

# 5 Main results

## 5.1 Farmers' connections to the farmer trainer

The first set of results focuses on whether the design variations affect the composition of the group of trainees. To limit the cost of providing training, FTs might limit knowledge diffusion to a few farmers they already know. To explore this potential drawback in the FT system, we look at the effect of the design variations on the share of trainees belonging or not to the FT's first-degree social network at baseline.

Results reported in Table 5 show that FTs assigned to the design variations train an average of 19 farmers more compared to the FTs assigned to the standard farmer-to-farmer model. This is almost the double number of farmers trained by FTs in the basic FT model. This effect is mainly due to an increase in the share of farmers closely linked to the FT (essentially with an agricultural tie) by 19.4 percentage points. The share of trainees more socially distant from the FT increases too, by 11 percentage points. Relative to the mean of the basic treatment, the size of these effects corresponds to a 46.5% and a 16.5% increase, respectively. In turn, farmers connected to the FT by other types of social dimensions are not more likely to be trained by FTs assigned to the design variations.

Although the share of trainees with a strong connection with the FT is significantly higher than in the basic treatment group in any of the three variations, the effect on the types of farmers differs across variations. First, the share of socially distant trainees increases only in villages assigned to the Linkage variation, and it is significantly different compared to the two other variations. Second, not all design variations have the same effect on the number of trainees. FTs in the Linkage variation train the highest number of farmers (+11.5), followed by those in the Sign-post variation (+7.6), whereas the number of trainees in the Needs Assessment variation does not significantly increase compared to the basic treatment group. The difference in the number of trainees is significantly different for the first two variations compared to the last one.

As explained above, trainees with a strong "agricultural tie" with an FT were surveyed at baseline, midline and endline. We use these data to further explore the type of relationship between trainees and the FTs (kinship, friendship, safety-net, etc.). Table 6 shows that FTs in the Linkage variation train a smaller share of trainees in almost all social dimensions. Friends and frequent-contact people are the least in attendance among trainees. In turn, FTs assigned to the Sign-post variation train a higher share of farmers already known at baseline: friends, neighbors, people to whom they talk often, and to or from whom they can lend or borrow money.

These results show that the Linkage variation is effective in reaching out to a larger number of trainees, and in particular to those more socially distant from the FT. The Sign-post variation manages to attract a higher number of farmers too, but the share of first-degree contacts is larger. Lastly, the Needs Assessment variation is not effective in attracting more farmers, and the share of those closely connected to the FT is larger than in the basic treatment group.

Overall, the design variations appear to have different effects on the type of farmers trained. FTs diffuse information more to a close circle of farmers when (i) information needs to be tailored to the trainees' needs and constraints (Needs Assessment) or (ii) the advertisement device is visible to close neighbors and farmers already used to visiting the FT (Signpost). Customizing information likely raises the cost of training, such that FTs compensate by targeting farmers more similar to them. The sign-post is a purely supply-side mechanism visible to farmers geographically and socially close to the FT. In both cases, the diffusion of information is directed rather towards a small group of farmers, possibly leaving (geographically or socially) distant farmers to one side.

The Linkage variation, in turn, seems to facilitate the diffusion of information to farmers socially distant from the FT. We can think of at least three main reasons for this. First, FTs in the Linkage variation can benefit from EA assistance with conducting training sessions, and two trainers can handle a wider range of trainees. Second, the larger number of training sessions given by FTs in this variation, as shown by Table A6, makes it easier for more farmers to attend at least one session. Third, farmers may value the presence of an extension agent during the training session and this may attract farmers who share no previous connection with the FT. All these reasons can of course coexist and are not mutually exclusive. We will come back to this in section 5.3.

## 5.2 Prominence of FTs

We now turn to investigating the complementarity between an FT's prominent position in the village and the design variations.

To start with, it is important to mention that the design variations are effective at galvanizing FTs to train fellow farmers (Table A6).They increase the likelihood for FTs to hold at least one training session by 13 percentage points, meaning that 95% of the FTs assigned to the treatment variations gave at least one training session, compared to 82% for the basic treatment group. Moreover, FTs gave an average of 6.6 more training sessions and trained on average 18.9 more trainees than FTs assigned to the basic treatment. These are large effects representing more than double the sessions and almost double the trainees in the basic treatment group. Importantly, training sessions did not get more crowded, as shown by the negative and non-significant coefficient in the 4th column. Among the three design variations, the Linkage variation appears to be the most effective (Table A6).[17]

In view of these results, we now move to the analysis of the FT's status in the village: do the design variations complement or substitute for an FT's prominent role? In other words, are they effective only if FTs are prominent persons in the village? Or do they compensate for the lack of FT popularity?

All our results point to the absence of any complementarity in terms of FT training activity between the design variations and the role of FTs in the village (Table 7). Being a prominent FT in the village does not appear to boost training activities when combined with any of the design variations. It is worth noting, nevertheless, that prominent FTs in the basic treatment group are more likely to hold at least one training session (column 1). This is explained by FTs belonging to a politically engaged household as shown by results reported in Table 8, column 1. On the other hand, FTs considered as successful dairy farmers by the sampled village farmers hold fewer training sessions when assigned to the basic treatment group. However, the treatment variations do not significantly affect either the activity of successful FTs or those with a political position.

Interestingly enough, we find that prominent FTs do not attract more socially distant farmers either. A focus on whether a prominent FT influences the type of farmers attending the training sessions finds no statistically significant effects (Table 7, columns 5-7). These results confirm that FTs assigned to the design variations trained a higher share of farmers from outside their

[17] Interestingly, the increase in the number of trainees and sessions associated with the Signpost intervention gives an idea of the demand for training. As explained above, this variation does not (directly) improve the quality of training, but merely advertises the FT's activity. Simply putting up a signpost outside the FT's residence, increases demand by 35.4% compared to the basic treatment group. We cannot say, however, whether the increase in the number of sessions is driven by an increase in demand or whether the farmer trainer feels obliged by the advertisement to hold more sessions, thereby driving up the number of trainees.

own close circle, but that there is no differential effect based on the FT's prominent role in the village.[18] Breaking down the prominence proxy by its three components (Table 8, columns 5-7) shows no significant heterogeneous results either. Yet, FTs living in politically connected households appear to be more likely to give at least one training session (column 1) and train a larger proportion of socially distant farmers (column 7). The treatment variations, however, do not appear to further stimulate the training activities of prominent FTs.

### 5.3 Do extension agents attract a broader spectrum of farmers?

The most likely explanation for the capacity of FTs in the Linkage variation to attract farmers from outside of their close social network, could be the role played by the extension agent. The core component of the Linkage variation was indeed the provision of vouchers to FTs to access professional extension services to visit their cattle and help with training sessions by providing technical support and additional information. Note that the FTs did not have to give training sessions in order to make use of the vouchers. In principle, the FT was entitled to use the voucher to pay for the Extension Agent even without setting up a training session. Similarly, the FTs could call upon the Extension Agent to simply visit his cattle without having to participate in a training session. Moreover, while the vouchers were distributed only to FTs in the Linkage variation, all the other FTs could still access extension services by paying a fee, as in the usual status quo.

We find that the Linkage intervention is indeed successful in securing assistance for FTs by extension agents. The regression results reported in Table A7 show that FTs in the Linkage variation were 37ppts (+108%) more likely to have received an EA visit in the past 12 months compared to the basic treatment group. They received an average of 4.5 more visits. This means that FTs redeemed two-thirds of the twelve vouchers provided.

However, they held slightly more training sessions than the number of EA visits received. Results in Table A6 show indeed that FTs in the Linkage variation gave an average of 12 training sessions, which is around four more than the number of EA visits received. Nevertheless, FTs in the Linkage variation are 18.5ppts more likely to have an EA helping out with the training session.[19] This is likely to reduce the FT's cost of training by sharing session management with the EA.

We test for whether the presence of an extension agent at a training session plays a significant role in attracting trainees using a mechanism analysis and a mediation analysis following (Imai et al., 2010). In the mechanism analysis, we test the robustness of the variations' coefficients to controlling for whether the EA led a training session. In the mediation analysis, we assess the mediator role of EA attendance at the training session by estimating the Average Causal Mediation Effect and the share of the total effect that is mediated. Table 9 shows that farmer participation is higher when sessions are led by an EA, including a higher level of attendance by

[18] Using a binary variable to measure FT's prominence instead of a categorical variable delivers the same results (results available from the authors).
[19] Note that the data do not specify how many times the EA helped out with the training sessions.

farmers more socially distant from the FT, but a lower level of attendance by first-degree links. This holds for all three treatment variations. Nevertheless, the main effect of the treatment variations on the number and type of trainees changes little compared to the results reported in Table 5. While the presence of an extension agent at the training session is correlated with more trainees, assignment to the treatment variations - in particular the Linkage and Signpost ones - still matters.

Results reported in Table 10 show the direct effect of all variations (Panel A) and each single variation (Panels B-D) on the set of outcomes given in the first column. The Average Causal Mediation Effect takes into account the role of EA attendance. The total effect is the combination of these two effects. On the whole, the presence of an extension agent at the training session is a significant mediator for the number of trainees and the share of high-degree contact trainees. This is true for the Linkage variation in particular. The presence of an extension agent at the training session appears to explain between 14% and 29% of the total effect of the Linkage variation on the set of outcomes.

To provide further insights into the role of extension agents in stimulating farmer participation in training sessions, we explore the reasons why FTs and farmers may appreciate the presence of an EA at training sessions. Results in Table A8 (Panel A) show that FTs in the Linkage variation report almost double the number of advantages than FTs in the basic treatment group. Similarly, farmers report 30% more advantages than farmers in the basic treatment group. Further results (available from the authors) show that FTs in the Linkage variation consider the EAs to be useful in helping with training fellow farmers and increasing their knowledge, making them accountable and overseeing their work. Moreover, farmers in the Linkage variation are found to be significantly more likely to report that the main advantage is to make FTs accountable and monitor their work. These results point to a dual mechanism behind the success of the Linkage variation. First, the physical presence of the EA attracts more farmers. Second, FTs gain public recognition among farmers secured by the EA's oversight.

Finally, thre may be concerns that the Linkage variation performed well simply because it introduced some sort of favoritism between the FT and the extension agent. Extension workers might focus their attention on FTs they already know, those perceived to have great potential, and may spend less time on more marginal farmers. To test for this, we explore whether EAs backstopped only those FTs they previously knew. Reassuringly, interacting assignment to the Linkage variation with baseline information on visits by an EA at baseline does not show any significant results (last 3 columns of Table A7). This corroborates the hypothesis that FTs were not cherry-picked by the EAs.

All in all, these results suggest that facilitating access to extension services promotes FT activity and stimulates demand for training. FTs in the Linkage variation benefited from an average of eight EA visits, but held several training sessions even in the absence of the EA. The presence of an EA during the training session appears to be appreciated by farmers, by making the FT more accountable. This is in line with complementarity between FTs and EAs. The latter have a higher status and are appropriate entry points to disseminate new information. The former are more similar to village farmers and are therefore able to persuade potential adopters of the merits of innovation (Fisher et al., 2018). A similar positive dynamic might be at play here, stimulating FT activity and attracting more trainees.

## 6 Secondary results

The question could be put as to whether attending the training sessions resulted in increased knowledge and/or adoption of dairy technologies among village farmers. The data provided by the attendance sheets do not unfortunately enable us to assess the effect of the treatment variations on trainee outcomes in terms of knowledge and adoption. The midline and endline survey data instead provide a rich variety of farmer-level outcomes, such as knowledge and adoption of dairy technologies, in addition to self-reported farmer participation in the training sessions and interactions with the FT. The unit of analysis is the farmer and we measure outcomes at the individual level, rather than the village level, as previously done for the analysis at the FT level.

Using the survey data means, however, having to rely on the selected sample of farmers with a much lower number of socially distant farmers than in the previous analysis based on the attendance sheets. Information on the attendance sheets exhaustively covers all trainees participating in the training sessions. In turn, the survey was conducted on a sample of just four farmers per village, three of whom were closely connected to the FT and only one outside the FT's first-degree contacts, randomly selected from the village list of dairy farmers. The sub-sample of "random farmers" is therefore only one-third the size of the farmers with an "agricultural tie", with considerable consequences in terms of variance and precision of the estimates. Nevertheless, by differentiating farmers along these two categories, we can further explore the effects of the treatment variations on farmers' outcomes depending on the farmers' previous connection with the FT.

We run the analysis on the entire sample, interacting the treatment variable with a dummy equal to one if the farmer is "random". It is, however, important to mention that this is only suggestive evidence, as omitted variables might drive the correlation between the type of farmer - being closely connected or not with the FT - and farmer-level outcomes.[20]

### 6.1 Farmer participation in training sessions.

We first replicate the previous analysis on farmer participation in training sessions with the information self-reported by sampled farmers in the midline and endline surveys. We couple the survey data with data from the attendance sheets in terms of likelihood of attending at least one session and number of sessions attended, as this information is available at the farmer level.

Results obtained from these two data sources are consistent. Columns 1 and 3 of Table 11 show that farmers living in a village assigned to one of the three treatment variations are more

[20] Moreover, a further limitation of this analysis is the possible positive reporting bias affecting responses provided by farmers who already know the FT, as they might, for instance, oversell their experience at the training sessions.

likely to attend at least one training session, irrespective of the data source used. Similarly, comparing column 5 with column 7 shows that these farmers attend more sessions on average than those in the basic treatment group.[21] Moreover, information from the survey data reveals that farmers in the treatment variation groups are more likely to discuss dairy farming with other villagers (column 13), even though they do not interact significantly more with the FT outside of the training sessions (columns 9 and 11).

Exploring heterogeneous effects depending on the FT's previous knowledge of the sampled farmers shows that the treatment variations were most effective at increasing attendance by farmers in the FT's close circle of contacts (columns 2, 4, 6 and 8). Results also show that, without the treatment variations, farmers socially distant from the FT are less likely to attend a training session, attend fewer sessions and are less likely to ask for advice from the FT in the basic treatment group.[22]

These results might appear to be at odds with our main results based on the attendance sheets. Most likely, however, the difference with respect to the attendance of socially distant farmers at training sessions is due to the sampling design. One randomly picked dairy farmer clearly does not appear to be representative enough of all the farmers attending the training sessions, as listed on the attendance sheets. This calls for the need to sample a larger number of farmers - in particular those socially distant from the FT - and to collect a broader spectrum of trainee outcomes using attendance sheets and monitoring tools.

### 6.2 Transmission of knowledge and adoption

Despite the survey sample and data limitations, we provide further suggestive evidence for the differential effects on farmers' knowledge and adoption of dairy technologies depending on their previous connection with the FT. Attendance at training sessions might, in fact, not automatically translate into higher levels of knowledge and adoption if there are frictions in the transmission of information.

Holding more sessions and training a larger number of farmers from a broader spectrum also means having to contend with a higher level of variance in terms of needs and constraints, possibly hampering the quality of training and making it harder for the FT to provide helpful advice to every single farmer. On the other hand, giving more sessions might help FTs to gain more self-confidence, improving training skills over time, and eventually increasing the quality of training. Good communicators should be able to effectively transmit knowledge and, provided farmers' constraints are not too binding, technology adoption should increase.

We build two indexes, one for knowledge and the other for the adoption of dairy feed and technologies at midline and endline. In line with Anderson (2008), these are built as weighted

[21] Interestingly, although the results are qualitatively similar, the sizes of the effects are quite different depending on the data source. Farmers in the basic treatment group declare attending more sessions than what is reported in the attendance sheet data. This makes the size of the variations' effect relative to the basic treatment group larger when using the attendance sheets data.

[22] Results for each treatment variation are qualitatively similar (results available from the authors).

indexes of multiple variables standardized with respect to the basic treatment group. For the knowledge (adoption) index, we consider whether or not the farmer knows (has used in the past 12 months) each of the 35 dairy feed and technologies covered by the training program.[23]

On the whole, results in Table 12 show no significant effect of the treatment variations on farmers' knowledge at midline or endline compared to farmers in the basic treatment group. Only adoption of dairy technologies increases at endline by 21% of a standard deviation (column 7). However, if we differentiate by type of sampled farmer, we observe a significant increase in knowledge at midline (+19.5% of a standard deviation) and in adoption at endline (+24% of a standard deviation) exclusively among farmers closely connected with the FT. Conversely, socially distant farmers do not appear to benefit from the knowledge transfer. Strikingly, their knowledge at midline is lower compared to the other farmers, but the overall treatment effect for random farmers is not statistically significant (p-value=0.154).[24] Along the same lines, further results suggest (Table A9) that only those farmers close to the FT are satisfied with the training given, while the random dairy farmers feel that the information delivered by the FT was poorly customized.

These results suggest that the diffusion of information by the FT-system presents considerable frictions, as knowledge transmission seems to favor those farmers already closely connected with the FT. While these results might be socially undesirable, they might also be inefficient. Farmers close to the FT do not appear to be significantly more productive than the randomly selected farmers. Descriptive statistics reported in Table A2 show that they do not own more heads of cattle or cows and that they do not produce more milk. We can also fairly certainly rule out the increase in knowledge and adoption as being due to a "catching-up" effect, since farmers close to the FT do not report a lower baseline level of knowledge or adoption of dairy feed and practices. Nevertheless, caution must be used when interpreting these results, as we cannot entirely rule out the possibility that other unobservable characteristics of dairy farmers close to the FTs might make their returns to technology adoption higher than for socially distant farmers.[25]

# 7 Robustness checks

We perform four robustness checks. The first check adjusts the p-values for multiple hypothesis testing using the Romano-Wolf stepdown p-values. The second check runs the main estimation, flexibly controlling for a vector of FT observable characteristics using the Lasso procedure. The third check controls for the imbalanced covariates between treatment variations and

[23] Behagel et al. (2020) find that, compared to the pure control group, farmers in the treatment group significantly increase their technology adoption, but not their knowledge. However, they do not find any effect of the single treatment variations on farmers' knowledge and adoption compared to the pure control group.

[24] Results for each treatment variation are qualitatively similar (results available from the authors).

[25] It would be ideal here to be able to measure a farmer's expected returns to technology adoption. It is not, however, straightforward to measure expected returns for 35 animal feed and dairy farming practices, as different farmers might obtain the greatest benefit from different combinations of these "technologies". This high number of "technologies" was, in fact, intended to satisfy the largest possible set of constraints and demand. Another challenge in this context is the lack of exogenous determinants of returns to technology across farmers.

the basic treatment groups found in Table 2. The fourth check runs the long regression model controlling for the interactions between the treatment variations (three double interactions and one triple interaction).

Table A10 reports, for each treatment variation, the model p-values and the Romano-wolf p-values estimated for the regressions on the main outcomes for the type of farmers trained by the FTs (as in Table 5).[26] All results are confirmed.

We further test whether these results hold using a Lasso procedure (Table A11). We run the specification including the three treatment variations and a set of observable FT characteristics. We take into account a list of 22 binary and categorical variables regarding household characteristics and dairy production. The main results are confirmed.

Results reported in Table A12 also confirm the main results when controlling for the covariates that were found to significantly differ between FTs in the variations and basic treatment groups.

Finally, the main results are confirmed when controlling for the set of interaction terms of the three treatment variations (Table A13). Interestingly, we observe a discouraging effect when adding the Signpost or the Needs Assessment intervention to a farmer trainer assigned to the Linkage one.

## Conclusions

The farmer-to-farmer system has been applied in a vast majority of developing countries to facilitate access to information on agricultural practices and technologies. farmer trainers (FTs) are often volunteers who are given a technical training and act as communicators to diffuse information in their village.

Yet, diffusion of information might be jeopardized. It might actually be easier for FTs to restrict knowledge diffusion to farmers similar to them and who they already know or to deliver information relevant only to those farmers sharing similar needs and constraints as the FT. Accessing information may become harder for marginal farmers, but easier for farmers closer to the FT. As a result, diffusion of information might be unequal and, possibly, ineffective. How to best design a farmer-to-farmer system is still an open question.

We explore whether variations to the standard FT-model are effective in diffusing information outside of the FT's agricultural social network, using an exhaustive dataset containing the full list of trainees for each training session held by FTs in the treatment group over a two-year period.

Our results show that the three experimental variations stimulate farmer trainers' activities to a different extent. In particular, facilitating access to technical information provided by professional extension agents appears to be the most effective way to make FTs diffuse information

[26] Results of the same check on other outcomes are available from the authors.

outside of their own close circle of farmers. Those FTs who received vouchers for extension services in addition to the basic training program trained more farmers, a higher proportion of whom were more socially distant from them.

Conversely, FTs under the Sign-post variation did not attract more farmers from outside their own agricultural network, possibly because the advertisement mechanism works mostly for geographically and socially close farmers rather than distant ones. Finally, the Needs Assessment variation appears to be ineffective at stimulating farmer participation. This is in line with a homophilious tendency, since it might be easier for the FT to customize information and follow up with trainees who are few close farmers living nearby and with whom the FT is already used to discussing dairy farming.

Despite the higher level of participation of socially distant farmers in the training sessions, considerable knowledge diffusion frictions appear to persist. Further evidence based on survey data collected from a smaller sample of farmers suggests that socially distant trainees do not benefit from the information transmission as much as trainees close to the FT. Self-reported knowledge and adoption of dairy feed and practices increases only among dairy farmers close to the FT. These results give cause for caution regarding the capacity of the FT-model to spread information to village farmers. Despite the effectiveness of the treatment variations at stimulating farmer trainer activity, the actual transmission of information along social connections still appears to play a predominant role.

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# Tables

Table 2: Characteristics of farmer trainers in basic treatment vs treatment variations.

| | Basic Treatment | | Variations | | |
|---|---|---|---|---|---|
| | Mean | Sd | Mean | Sd | Diff |
| Male HHH | 0.98 | 0.15 | 0.94 | 0.24 | -0.04 |
| Age HHH | 44.20 | 14.78 | 41.98 | 11.71 | -2.22 |
| HHH attended school | 0.95 | 0.21 | 0.99 | 0.11 | 0.03 |
| Completed high school | 0.28 | 0.45 | 0.34 | 0.47 | 0.06 |
| Off-farm activity HHH | 0.66 | 0.48 | 0.67 | 0.47 | 0.01 |
| Household size | 8.84 | 5.19 | 7.87 | 3.90 | -0.97 |
| Nb. children in the household | 5.75 | 4.75 | 4.92 | 3.37 | -0.83 |
| FT most successful (share) | 0.20 | 0.24 | 0.18 | 0.24 | -0.02 |
| FT closest (share) | 0.18 | 0.19 | 0.22 | 0.22 | 0.03 |
| HH has/had member part of a committee | 0.36 | 0.49 | 0.37 | 0.48 | 0.00 |
| Prominence of FT | 1.43 | 0.90 | 1.44 | 0.90 | 0.01 |
| At least one prominence dimension | 0.86 | 0.35 | 0.84 | 0.37 | -0.02 |
| Uses a savings institution | 0.68 | 0.47 | 0.74 | 0.44 | 0.05 |
| Borrowed money from an institution | 0.43 | 0.50 | 0.52 | 0.50 | 0.09 |
| Nb. cows | 2.48 | 3.92 | 2.22 | 2.76 | -0.26 |
| Nb. heads of cattle | 8.39 | 17.05 | 6.15 | 6.53 | -2.23 |
| Produces milk | 0.89 | 0.32 | 0.82 | 0.39 | -0.07 |
| Average milk production per day | 4.54 | 8.28 | 3.73 | 4.71 | -0.81 |
| Sells milk | 0.50 | 0.51 | 0.44 | 0.50 | -0.06 |
| Nb. feed known | 8.95 | 1.54 | 8.81 | 2.22 | -0.15 |
| Nb. feed used | 5.00 | 1.18 | 4.77 | 1.56 | -0.23 |
| Nb. technologies known | 18.16 | 2.65 | 17.52 | 3.24 | -0.63 |
| Nb. technologies used | 9.25 | 2.57 | 8.56 | 2.63 | -0.69* |
| Land size in acres | 9.67 | 12.07 | 9.17 | 16.02 | -0.50 |
| Size of social network | 10.98 | 0.15 | 10.90 | 0.67 | -0.07* |
| Obs. | | | | | 395 |
| Joint F-test | | | | | 1.15 |
| p-value | | | | | 0.288 |

*Notes:* This table shows the mean and standard deviations of farmer trainers' characteristics at baseline. Sample made of farmer trainers in the treatment group only. The Diff column reports the regression coefficient of a dummy equal to one if the FT is assigned to one of the treatment variations compared to the basic treatment group for each single variable, with clustered standard errors at the village level. Stars indicate whether this difference is significantly different from zero.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 3: Characteristics of sampled farmers in basic treatment vs treatment variations.

| | **Basic Treatment** | | **Variations** | | |
|---|---|---|---|---|---|
| | Mean | Sd | Mean | Sd | Diff |
| Male HHH | 0.92 | 0.28 | 0.90 | 0.30 | -0.01 |
| Age HHH | 45.47 | 13.40 | 46.73 | 13.83 | 1.26 |
| HHH attended school | 0.89 | 0.31 | 0.87 | 0.34 | -0.02 |
| Off-farm activity HHH | 0.48 | 0.50 | 0.46 | 0.50 | -0.02 |
| Household size | 9.17 | 4.28 | 8.68 | 4.08 | -0.49 |
| Nb. children in the household | 5.77 | 3.90 | 5.44 | 3.77 | -0.32 |
| Considers FT most successful farmer | 0.21 | 0.41 | 0.18 | 0.39 | -0.02 |
| Considers FT closest farmer | 0.17 | 0.38 | 0.21 | 0.41 | 0.04 |
| HH has/had member part of a committee | 0.33 | 0.47 | 0.33 | 0.47 | 0.00 |
| Uses a savings institution | 0.56 | 0.50 | 0.64 | 0.48 | 0.08** |
| Borrowed money from an institution | 0.40 | 0.49 | 0.45 | 0.50 | 0.05 |
| Nb. cows | 2.46 | 3.77 | 2.28 | 3.53 | -0.19 |
| Nb. heads of cattle | 6.78 | 7.80 | 6.29 | 8.28 | -0.49 |
| Produces milk | 0.83 | 0.38 | 0.83 | 0.38 | -0.00 |
| Average milk production per day | 3.03 | 4.26 | 2.94 | 4.50 | -0.09 |
| Sells milk | 0.41 | 0.49 | 0.42 | 0.49 | 0.02 |
| Nb. feed known | 7.97 | 2.03 | 7.72 | 2.10 | -0.25 |
| Nb. feed used | 3.34 | 1.95 | 3.70 | 1.85 | 0.37 |
| Nb. technologies known | 15.57 | 2.97 | 15.14 | 3.27 | -0.43 |
| Nb. technologies used | 6.51 | 3.23 | 6.70 | 2.89 | 0.19 |
| Land size in acres | 8.25 | 12.01 | 8.38 | 14.08 | 0.13 |
| Obs. | | | | | 1587 |
| Joint F-test | | | | | 1.06 |
| p-value | | | | | 0.393 |

*Notes:* This table shows the mean and standard deviations of sampled farmers' characteristics measured at baseline. Sample made of sampled farmers in the treatment group only. The Diff column reports the regression coefficient of each single variable on a dummy equal to one if the farmer lives in a village assigned to one of the treatment variations compared to the basic treatment group. Clustered standard errors at the village level. Stars indicate whether the difference is significantly different from zero.

$*p < 0.10$, $**p < 0.05$, $***p < 0.01$

Table 4: Characteristics of farmer trainers vs sampled farmers.

| | Sampled farmers | | Farmer trainers | | |
|---|---|---|---|---|---|
| | Mean | Sd | Mean | Sd | Diff |
| Male HHH | 0.90 | 0.30 | 0.94 | 0.23 | 0.04*** |
| Age HHH | 46.59 | 13.78 | 42.23 | 12.09 | -4.36*** |
| Household size | 8.73 | 4.11 | 7.98 | 4.07 | -0.75*** |
| HHH attended school | 0.87 | 0.33 | 0.98 | 0.12 | 0.11*** |
| Off-farm activity HHH | 0.47 | 0.50 | 0.67 | 0.47 | 0.20*** |
| HH has/had member part of a committee | 0.33 | 0.47 | 0.37 | 0.48 | 0.04 |
| Uses a savings institution | 0.63 | 0.48 | 0.73 | 0.44 | 0.10*** |
| Borrowed money from an institution | 0.44 | 0.50 | 0.51 | 0.50 | 0.07** |
| Nb. cows | 2.30 | 3.56 | 2.25 | 2.91 | -0.05 |
| Nb. heads of cattle | 6.35 | 8.22 | 6.40 | 8.38 | 0.06 |
| Produces milk | 0.83 | 0.38 | 0.83 | 0.38 | -0.00 |
| Average milk production per day | 2.95 | 4.48 | 3.82 | 5.22 | 0.87*** |
| Sells milk | 0.42 | 0.49 | 0.45 | 0.50 | 0.02 |
| Nb. feed known | 7.75 | 2.09 | 8.82 | 2.15 | 1.08*** |
| Nb. feed used | 3.66 | 1.86 | 4.79 | 1.53 | 1.13*** |
| Nb. technologies known | 15.19 | 3.24 | 17.59 | 3.18 | 2.41*** |
| Nb. technologies used | 6.67 | 2.93 | 8.64 | 2.63 | 1.96*** |
| Land size in acres | 8.37 | 13.86 | 9.22 | 15.62 | 0.85 |
| Obs. | | | | | 1981 |
| Joint F-test | | | | | 30.50 |
| p-value | | | | | 0.000 |

*Notes:* This table shows the mean and standard deviations of farmer trainers and sampled farmers' characteristics measured at baseline. The Diff column reports the regression coefficient of a dummy equal to one for being a farmer trainer compared to being a sampled farmer, with clustered standard errors at the village level. Sample of FTs and sampled farmers in the treatment group only. Stars indicate whether this difference is significantly different from zero.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5: Effect of the treatment variations on the type of trainees.

| | $\beta$ | **Const.** | **Mean dep. var.** | **N** |
|---|---|---|---|---|
| ***Panel A: All variations*** | | | | |
| Nb. trainees | 18.930*** | 20.860*** | 22.160 | 395 |
| | (4.06) | (3.48) | | |
| Share of trainees in close circle | 0.194*** | 0.417*** | 0.420 | 395 |
| | (0.06) | (0.06) | | |
| Share of first-degree trainees | 0.017 | 0.137*** | 0.140 | 395 |
| | (0.03) | (0.02) | | |
| Share of higher-degree trainees | 0.112** | 0.680*** | 0.680 | 395 |
| | (0.05) | (0.05) | | |
| ***Panel B: Linkage*** | | | | |
| Nb. trainees | 11.502*** | 31.886*** | 22.160 | 395 |
| | $(3.32)^{n}$ | (2.33) | | |
| Share of trainees in close circle | 0.074* | 0.552*** | 0.420 | 395 |
| | (0.03) | (0.03) | | |
| Share of first-degree trainees | -0.004 | 0.154*** | 0.140 | 395 |
| | (0.01) | (0.01) | | |
| Share of higher-degree trainees | 0.112*** | 0.723*** | 0.680 | 395 |
| | $(0.02)^{s,n}$ | (0.02) | | |
| ***Panel C: Signpost*** | | | | |
| Nb. trainees | 7.638* | 33.833*** | 22.160 | 395 |
| | $(3.41)^{n}$ | (1.93) | | |
| Share of trainees in close circle | 0.083* | 0.547*** | 0.420 | 395 |
| | (0.04) | (0.03) | | |
| Share of first-degree trainees | 0.020 | 0.141*** | 0.140 | 395 |
| | (0.01) | (0.01) | | |
| Share of higher-degree trainees | -0.003 | 0.781*** | 0.680 | 395 |
| | $(0.03)^{l}$ | (0.02) | | |
| ***Panel D: Needs Assessment*** | | | | |
| Nb. trainees | -0.112 | 37.737*** | 22.160 | 395 |
| | $(3.40)^{l,s}$ | (2.40) | | |
| Share of trainees in close circle | 0.087* | 0.545*** | 0.420 | 395 |
| | (0.04) | (0.03) | | |
| Share of first-degree trainees | 0.006 | 0.149*** | 0.140 | 395 |
| | (0.01) | (0.01) | | |
| Share of higher-degree trainees | 0.023 | 0.768*** | 0.680 | 395 |
| | $(0.03)^{l}$ | (0.02) | | |

*Notes:* Each line shows the estimated effect of the OLS regression of the outcome listed in the left column on variations on the basic treatment. Panel A shows the ITT results of being assigned to one of the treatment variations compared to the basic treatment. Panels B, C and D show the results of each single treatment variation. Analysis limited to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. "Nb. trainees" is the number of unique trainees measured from the attendance sheets for each FT. "Share of trainees in close circle" is the number of trainees among the first-degree sampled farmers appearing on the attendance sheets, divided by the number of FTs' first-degree sampled farmers. "Share of first-degree trainees" is the number of first-degree farmers listed in the FT's social network at baseline and appearing on the attendance sheets, divided by the number of first-degree farmers listed in the FTs' social network. "Share of higher-degree trainees" is the number of farmers appearing on the attendance sheets but not in the FT's social network, divided by the number of trainees on the attendance sheets at the FT-level. Indexes *l, s, n* indicate significant differences between estimated coefficients across variations with p-values at least below 10% ($l$ = if significantly different from Linkage; $s$ = if significantly different from Signpost; $n$ = if significantly different from Needs Assessment). * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Table 6: Effect of treatment variations on the share of sampled trainees connected with the FT, by type of social network dimension.

| | (1) **Share of friends** | (2) **Share talking often** | (3) **Share of neigbor** | (4) **Share of kin** | (5) **Share talking at mosque** | (6) **Share borrowing money** | (7) **Share lending money** |
|---|---|---|---|---|---|---|---|
| Variation | 0.007 | 0.012 | 0.007 | 0.017*** | 0.002 | 0.021 | 0.020 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Constant | 0.082*** | 0.068*** | 0.070*** | 0.023 | 0.027 | 0.049** | 0.050** |
| | (0.03) | (0.02) | (0.03) | (0.02) | (0.02) | (0.02) | (0.02) |
| Linkage | -0.033*** | -0.031*** | -0.030*** | -0.011* | -0.020** | -0.028*** | -0.025** |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Constant | 0.103*** | 0.094*** | 0.090*** | 0.044** | 0.037** | 0.081*** | 0.080*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Signpost | 0.030*** | 0.030*** | 0.024** | 0.007 | 0.012 | 0.031*** | 0.029*** |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Constant | 0.072*** | 0.063*** | 0.064*** | 0.035* | 0.022 | 0.051*** | 0.052*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.02) | (0.02) |
| Needs Assessment | -0.005 | -0.006 | -0.005 | 0.006 | 0.000 | -0.009 | -0.009 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Constant | 0.092*** | 0.084*** | 0.080*** | 0.035* | 0.029* | 0.075*** | 0.075*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| Observations | 395 | 395 | 395 | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 0.07 | 0.07 | 0.06 | 0.00 | 0.04 | 0.05 | 0.05 |
| P-values | | | | | | | |
| *Linkage = Signpost* | 0.00 | 0.00 | 0.00 | 0.09 | 0.05 | 0.00 | 0.00 |
| *Linkage = Needs Assessment* | 0.06 | 0.08 | 0.05 | 0.02 | 0.11 | 0.18 | 0.24 |
| *Signpost = Need Assessment* | 0.03 | 0.03 | 0.05 | 0.91 | 0.35 | 0.01 | 0.02 |

*Notes*: Each column shows the estimated effect of the OLS regression of the treatment variations. The first part of the table shows the ITT results of being assigned to one of the treatment variations compared to the basic treatment. The rest of the table reports the results for each single treatment variation. Each regression includes strata fixed effects, and error terms clustered at the village level. Outcomes measure the share of trainees with a social relationship with the FT. These are the shares of trainees among: the FT's friends, those with whom the FT talks often to, the FT's neighbors, the FT's relatives, those with whom the FT talks at church/mosque, those to and from whom the FT could lend or borrow money.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Heterogeneous effects of treatment variations on training activities by FT prominence.

| | (1) At least one session | (2) Nb. sessions | (3) Nb. trainees | (4) Nb. trainees per session | (5) Share of trainees in close circle | (6) Share of first-degree trainees | (7) Share of higher-degree trainees |
|---|---|---|---|---|---|---|---|
| Variation=1 | 0.299** | 6.763*** | 20.539*** | 0.735 | 0.223** | 0.047 | 0.252** |
| | (0.13) | (1.84) | (7.75) | (1.76) | (0.11) | (0.04) | (0.12) |
| FT prominent | 0.123* | -0.554 | -0.107 | 1.032 | 0.045 | 0.022 | 0.102 |
| | (0.07) | (0.93) | (3.57) | (0.77) | (0.06) | (0.02) | (0.06) |
| Variation=1 × FT prominent | -0.119 | -0.121 | -1.113 | -0.813 | -0.021 | -0.021 | -0.098 |
| | (0.07) | (1.07) | (4.05) | (0.81) | (0.06) | (0.02) | (0.06) |
| Constant | 0.646*** | 2.828 | 10.769 | 4.982** | 0.318** | 0.124** | 0.522*** |
| | (0.14) | (2.21) | (9.34) | (1.97) | (0.13) | (0.06) | (0.13) |
| Linkage =1 | 0.159** | 4.799** | 7.697 | 0.395 | 0.127 | 0.034 | 0.125* |
| | (0.05) | (1.69) | (6.88) | (0.81) | (0.07) | (0.03) | (0.05) |
| FT prominent | 0.035 | -0.672 | -2.174 | 0.419 | 0.044 | 0.015 | 0.020 |
| | (0.03) | (0.69) | (2.91) | (0.31) | (0.03) | (0.01) | (0.02) |
| Linkage =1 × FT prominent | -0.035 | 0.162 | 2.627 | -0.239 | -0.036 | -0.026 | -0.009 |
| | (0.03) | (0.97) | (3.72) | (0.43) | (0.04) | (0.01) | (0.03) |
| Constant | 0.850*** | 6.992*** | 26.368** | 5.470*** | 0.470*** | 0.153*** | 0.697*** |
| | (0.08) | (1.79) | (8.06) | (1.07) | (0.09) | (0.05) | (0.08) |
| Signpost =1 | 0.076 | 2.129 | 14.526* | 0.146 | 0.095 | 0.005 | 0.071 |
| | (0.06) | (1.76) | (6.75) | (0.82) | (0.07) | (0.03) | (0.06) |
| FT prominent | 0.037 | -0.339 | 1.553 | 0.431 | 0.033 | -0.002 | 0.039 |
| | (0.02) | (0.74) | (2.13) | (0.30) | (0.03) | (0.01) | (0.02) |
| Signpost =1 × FT prominent | -0.039 | -0.541 | -4.818 | -0.271 | -0.007 | 0.011 | -0.050 |
| | (0.03) | (1.03) | (3.72) | (0.43) | (0.04) | (0.01) | (0.03) |
| Constant | 0.877*** | 7.911*** | 21.560** | 5.564*** | 0.469*** | 0.164*** | 0.713*** |
| | (0.08) | (2.02) | (7.21) | (1.11) | (0.09) | (0.05) | (0.08) |
| Needs Assessment=1 | 0.051 | 2.901* | -7.061 | -1.006 | 0.149** | 0.028 | 0.023 |
| | (0.06) | (1.72) | (7.03) | (0.83) | (0.07) | (0.03) | (0.05) |
| FT prominent | 0.025 | -0.324 | -3.606 | 0.106 | 0.049* | 0.011 | 0.015 |
| | (0.03) | (0.66) | (3.28) | (0.35) | (0.03) | (0.01) | (0.03) |
| Needs Assessment=1 × FT prominent | -0.015 | -0.614 | 4.831 | 0.379 | -0.043 | -0.015 | 0.000 |
| | (0.03) | (0.99) | (3.80) | (0.44) | (0.04) | (0.01) | (0.03) |
| Constant | 0.888*** | 7.251*** | 34.014*** | 6.266*** | 0.430*** | 0.150*** | 0.737*** |
| | (0.07) | (1.91) | (8.39) | (1.12) | (0.09) | (0.05) | (0.07) |
| Observations | 395 | 395 | 395 | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 0.82 | 5.05 | 22.16 | 6.48 | 0.42 | 0.14 | 0.68 |

*Notes*: Each column shows the estimated effect of the treatment variations interacted with FT prominence on a set of outcomes. "At least one session" is a dummy equal to one if the FT ever held a training session after baseline data collection. "Nb.sessions" is the total number of training sessions given by an FT. "Nb. trainees" is the number of separate trainees trained by each FT. "Nb. trainees per session" is the ratio of the number of separate trainees to the number of sessions held. Outcomes in columns 1-4 are measured from the attendance sheets at the FT level. For outcomes in columns 5-7, see Table 5 notes. Analysis restricted to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. "FT prominent" is a categorical variable between 0 and 3, equal to the sum of three dummy variables regarding the FT measured at baseline (most successful farmer, closest neighbor, political position). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Heterogeneous effects of treatment variations on training activities by the three dimensions of FT's prominence.

| | (1) At least one session | (2) Nb. sessions | (3) Nb. trainees | (4) Nb. trainees per session | (5) Share of trainees in close circle | (6) Share of first-degree trainees | (7) Share of higher-degree trainees |
|---|---|---|---|---|---|---|---|
| Variation=1 | 0.189** | 5.552*** | 15.626*** | -0.288 | 0.217*** | 0.039 | 0.150** |
| | (0.08) | (1.36) | (5.47) | (1.30) | (0.07) | (0.02) | (0.07) |
| FT successful | 0.066 | -2.061** | -5.134 | 0.315 | 0.013 | 0.026 | 0.041 |
| | (0.04) | (0.88) | (3.80) | (0.71) | (0.05) | (0.03) | (0.04) |
| Variation=1 × FT successful | -0.079* | 1.318 | 4.286 | -0.169 | -0.031 | -0.029 | -0.050 |
| | (0.04) | (1.04) | (4.30) | (0.75) | (0.05) | (0.03) | (0.05) |
| Constant | 0.764*** | 3.528* | 14.490* | 6.166*** | 0.354*** | 0.135*** | 0.630*** |
| | (0.10) | (1.97) | (8.12) | (1.61) | (0.10) | (0.05) | (0.10) |
| Variation=1 | 0.192* | 6.293*** | 18.561*** | -0.138 | 0.236** | 0.033 | 0.159* |
| | (0.09) | (1.26) | (4.77) | (1.30) | (0.08) | (0.03) | (0.08) |
| FT closest neighbor | 0.098 | -0.569 | -1.228 | 0.505 | 0.098 | 0.018 | 0.080 |
| | (0.06) | (1.25) | (4.32) | (1.00) | (0.06) | (0.02) | (0.06) |
| Variation=1 × FT closest neighbor | -0.095 | 0.455 | 0.702 | -0.439 | -0.071 | -0.022 | -0.072 |
| | (0.06) | (1.39) | (4.69) | (1.03) | (0.07) | (0.02) | (0.06) |
| Constant | 0.750*** | 2.678 | 11.748 | 6.015*** | 0.314** | 0.140** | 0.610*** |
| | (0.10) | (1.92) | (7.78) | (1.59) | (0.11) | (0.05) | (0.10) |
| Variation=1 | 0.190** | 7.528*** | 22.306*** | -0.028 | 0.215*** | 0.018 | 0.173** |
| | (0.08) | (1.22) | (5.77) | (1.38) | (0.08) | (0.04) | (0.08) |
| FT's HH political position=1 | 0.205** | 1.713 | 6.066 | 1.261 | 0.084 | 0.011 | 0.194** |
| | (0.10) | (1.86) | (6.49) | (1.69) | (0.11) | (0.04) | (0.09) |
| Variation=1 × FT's HH political position=1 | -0.167 | -2.658 | -9.449 | -1.074 | -0.055 | -0.002 | -0.165* |
| | (0.10) | (2.06) | (7.45) | (1.74) | (0.11) | (0.04) | (0.10) |
| Constant | 0.749*** | 1.679 | 8.809 | 5.921*** | 0.344*** | 0.151*** | 0.599*** |
| | (0.10) | (1.84) | (8.17) | (1.67) | (0.11) | (0.05) | (0.10) |
| Observations | 395 | 395 | 395 | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 0.82 | 5.05 | 22.16 | 6.48 | 0.42 | 0.14 | 0.68 |

*Notes*: Each column shows the estimated effect of the treatment variations interacted with a measure of FT prominence. Each part of the table shows the effect of FTs being assigned to one of the three treatment variations interacted with: FT being identified as the most successful dairy farmer ("FT successful"), FT being the geographically closest dairy farmer ("FT closest neighbor") and FT being in a household with at least one member who is on a political committee ("FT's HH political position"). Analysis restricted to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. "FT successful" measures the number of farmers identifying the FT as the most successful dairy farmer in the village. "FT closest neighbor" measures the number of farmers identifying the FT as their closest dairy farmer in the village. "FT's HH political position" is a dummy equal to one if the FT or a household member sits on a political committee as measured at baseline.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Effect on trainee type, by variation. Controlling for training sessions led by an extension agent (EA).

| | (1) Nb. trainees | (2) Share of trainees in close circle | (3) Share of first-degree trainees | (4) Share of higher-degree trainees |
|---|---|---|---|---|
| Variation | 16.943*** | 0.188*** | 0.022 | 0.098* |
| | (3.93) | (0.06) | (0.03) | (0.05) |
| EA-led training | 10.740*** | 0.031 | -0.029** | 0.074*** |
| | (3.97) | (0.04) | (0.01) | (0.02) |
| Constant | 8.964 | 0.364*** | 0.160*** | 0.648*** |
| | (7.54) | (0.09) | (0.05) | (0.08) |
| Linkage | 9.145* | 0.067 | 0.003 | 0.100*** |
| | (3.84) | (0.04) | (0.01) | (0.03) |
| EA-led training | 9.209* | 0.026 | -0.027* | 0.049* |
| | (4.54) | (0.04) | (0.01) | (0.02) |
| Constant | 21.420** | 0.513*** | 0.179*** | 0.706*** |
| | (7.21) | (0.08) | (0.04) | (0.07) |
| Signpost | 7.869* | 0.084* | 0.020 | -0.001 |
| | (3.38) | (0.04) | (0.01) | (0.03) |
| EA-led training | 12.599** | 0.052 | -0.026 | 0.083*** |
| | (3.93) | (0.04) | (0.01) | (0.02) |
| Constant | 19.724** | 0.486*** | 0.168*** | 0.737*** |
| | (6.80) | (0.08) | (0.04) | (0.07) |
| Needs Assessment | -0.341 | 0.086** | 0.007 | 0.022 |
| | (3.38) | (0.04) | (0.01) | (0.03) |
| EA-led training | 12.413*** | 0.047 | -0.027* | 0.083*** |
| | (3.96) | (0.04) | (0.01) | (0.02) |
| Constant | 24.455*** | 0.475*** | 0.175*** | 0.722*** |
| | (7.07) | (0.08) | (0.04) | (0.07) |
| Observations | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 22.16 | 0.42 | 0.14 | 0.68 |
| P-values | | | | |
| *Linkage = Signpost* | 0.81 | 0.74 | 0.40 | 0.00 |
| *Linkage = Needs Assessment* | 0.02 | 0.69 | 0.82 | 0.01 |
| *Signpost= Needs Assessment* | 0.08 | 0.96 | 0.49 | 0.53 |

*Notes*: Each column shows the estimated effect of the OLS regression of a set of outcomes on the treatment variations while controlling for whether an EA led a training session. "EA-led training" is a dummy variable equal to 1 if an EA led at least one of the FT's training sessions and 0 otherwise. The first part of the table shows the ITT results for assignment to one of the treatment variations compared to the basic treatment. The rest of the table reports the results for each single treatment variation. Analysis restricted to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 10: Effect on trainee type, by variation. Mediation analysis.

| | **Direct effect** | **ACME** | **Total effect** | **% of tot. effect** |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ***Panel A: All variations*** | | | | |
| Nb. trainees | 15.17 | 2.39 | 17.55 | 0.14 |
| *Conf. intervals* | [21.02, 9.37] | [4.50, 0.80] | [23.43, 11.55] | [0.21, 0.10] |
| Share close trainees | 0.18 | 0.01 | 0.19 | 0.05 |
| *Conf. intervals* | [0.28, 0.08] | [0.02, -0.00] | [0.28, 0.09] | [0.09, 0.03] |
| Share first-degree | 0.02 | -0.00 | 0.02 | -0.12 |
| *Conf. intervals* | [0.07, -0.02] | [-0.00, -0.01] | [0.06, -0.02] | [1.27, -1.04] |
| Share of high-degree | 0.10 | 0.01 | 0.11 | 0.13 |
| *Conf. intervals* | [0.19, 0.00] | [0.03, 0.01] | [0.20, 0.02] | [0.45, 0.07] |
| ***Panel B: Linkage*** | | | | |
| Nb. trainees | 8.13 | 3.19 | 11.32 | 0.28 |
| *Conf. intervals* | [14.94, 1.40] | [5.72, 1.06] | [17.14, 5.50] | [0.57, 0.19] |
| Share close trainees | 0.06 | 0.01 | 0.07 | 0.16 |
| *Conf. intervals* | [0.12, -0.00] | [0.03, -0.00] | [0.13, 0.01] | [0.51, 0.08] |
| Share first-degree | 0.00 | -0.01 | -0.00 | 0.29 |
| *Conf. intervals* | [0.03, -0.02] | [-0.00, -0.01] | [0.02, -0.03] | [4.03, -3.16] |
| Share of high-degree | 0.10 | 0.02 | 0.11 | 0.14 |
| *Conf. intervals* | [0.14, 0.05] | [0.03, 0.01] | [0.15, 0.07] | [0.22, 0.10] |
| ***Panel C: Sign-post*** | | | | |
| Nb. trainees | 7.54 | -0.20 | 7.34 | -0.03 |
| *Conf. intervals* | [13.35, 1.79] | [1.01, -1.57] | [13.05, 1.54] | [-0.01, -0.09] |
| Share close trainees | 0.09 | -0.00 | 0.09 | -0.01 |
| *Conf. intervals* | [0.15, 0.03] | [0.01, -0.01] | [0.14, 0.03] | [-0.01, -0.03] |
| Share first-degree | 0.02 | 0.00 | 0.02 | 0.01 |
| *Conf. intervals* | [0.04, -0.00] | [0.00, -0.00] | [0.04, -0.00] | [0.06, -0.02] |
| Share of high-degree | -0.00 | -0.00 | -0.01 | 0.03 |
| *Conf. intervals* | [0.04, -0.05] | [0.01, -0.01] | [0.04, -0.05] | [0.36, -0.32] |
| ***Panel D: Needs Assessment*** | | | | |
| Nb. trainees | -1.00 | 0.31 | -0.69 | -0.06 |
| *Conf. intervals* | [4.90, -6.84] | [1.65, -0.97] | [5.10, -6.54] | [0.60, -0.69] |
| Share close trainees | 0.08 | 0.00 | 0.08 | 0.02 |
| *Conf. intervals* | [0.14, 0.02] | [0.01, -0.00] | [0.14, 0.02] | [0.05, 0.01] |
| Share first-degree | 0.01 | -0.00 | 0.01 | -0.03 |
| *Conf. intervals* | [0.03, -0.01] | [0.00, -0.00] | [0.03, -0.01] | [0.25, -0.20] |
| Share of high-degree | 0.02 | 0.00 | 0.02 | 0.05 |
| *Conf. intervals* | [0.06, -0.03] | [0.01, -0.01] | [0.06, -0.02] | [0.45, -0.43] |

*Notes*: The direct effect is the effect of the treatment variations on the outcome variables listed in the first column. ACME is the Average Causal Mediation Effect. The last column presents the mediated proportion of the total effect. Estimates obtained from the parametric mediation algorithm applying 1,000 simulations, as described in Imai et al. (2010) .

Table 11: Effect on farmer participation in training sessions and their interaction with farmer trainer.

| | **Training attendance (survey)** | | **Training attendance (AS)** | | **Nb. sessions(survey)** | | **Nb. sessions(AS)** | | **Visited by FT** | | **Asked FT for advice** | | **Talks about dairy farming** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| Variation | 0.121** | | 0.246*** | | 1.404** | | 0.924*** | | 0.059 | | 0.066 | | 0.101** | |
| | (0.05) | | (0.05) | | (0.60) | | (0.22) | | (0.05) | | (0.04) | | (0.05) | |
| Variation=1 | | 0.133*** | | 0.259*** | | 1.347* | | 0.972*** | | 0.072 | | 0.061 | | 0.098* |
| | | (0.05) | | (0.06) | | (0.73) | | (0.27) | | (0.05) | | (0.05) | | (0.05) |
| Random dairy farmer=1 | | -0.068 | | -0.146** | | -1.044* | | -0.653** | | -0.085 | | -0.194** | | -0.007 |
| | | (0.08) | | (0.07) | | (0.63) | | (0.26) | | (0.10) | | (0.08) | | (0.02) |
| Variation=1 × Random dairy farmer=1 | | -0.047 | | -0.052 | | 0.239 | | -0.190 | | -0.052 | | 0.025 | | 0.011 |
| | | (0.08) | | (0.08) | | (0.72) | | (0.29) | | (0.10) | | (0.08) | | (0.02) |
| Constant | 0.422*** | 0.439*** | 0.273** | 0.309*** | 2.061 | 2.324 | 0.491 | 0.656 | 0.600*** | 0.622*** | 0.310*** | 0.358*** | 0.680*** | 0.682*** |
| | (0.08) | (0.08) | (0.11) | (0.11) | (1.38) | (1.43) | (0.43) | (0.46) | (0.07) | (0.07) | (0.08) | (0.08) | (0.11) | (0.11) |
| Observations | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 | 1561 | 1561 | 1596 | 1596 | 1596 | 1596 |
| Dep. var. mean basic treatment | 0.531 | 0.531 | 0.313 | 0.313 | 2.263 | 2.263 | 0.804 | 0.804 | 0.591 | 0.591 | 0.441 | 0.441 | 0.849 | 0.849 |
| P-values | | | | | | | | | | | | | | |
| *Random d.f.=Interaction* | | 0.891 | | 0.516 | | 0.327 | | 0.389 | | 0.866 | | 0.159 | | 0.680 |
| *Variation=Interaction* | | 0.100 | | 0.011 | | 0.416 | | 0.030 | | 0.372 | | 0.747 | | 0.116 |

*Notes*: Each column shows the estimated effect of the OLS regression of a set of outcomes at the farmer level on living in a village assigned to one of the three treatment variations. For each outcome, two specifications are reported: the first for the effect of treatment variation assignment ("Variation") and the second with an interaction term between treatment variation assignment and being a random dairy farmer. "Random dairy farmer" is a dummy variable equal to one if the sample farmer is absent from the FT's list of first-degree contacts and was randomly selected from the village list of dairy farmers and 0 otherwise. Outcomes in columns 3, 4, 7 and 8 are measured from the attendance sheets. All other outcomes are measured from the midline and endline surveys. Analysis restricted to sampled farmers in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Effect on farmers' knowledge and adoption of dairy feed and techniques.

| | Knowledge | | | | Adoption | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) Midline | (2) Midline | (3) Endline | (4) Endline | (5) Midline | (6) Midline | (7) Endline | (8) Endline |
| Variation | 0.097 | | 0.100 | | 0.091 | | 0.211** | |
| | (0.08) | | (0.10) | | (0.08) | | (0.09) | |
| Variation=1 | | 0.195** | | 0.154 | | 0.145 | | 0.242*** |
| | | (0.10) | | (0.11) | | (0.09) | | (0.09) |
| Random dairy farmer=1 | | 0.262 | | 0.016 | | 0.129 | | -0.042 |
| | | (0.17) | | (0.14) | | (0.16) | | (0.15) |
| Variation=1 × Random dairy farmer=1 | | -0.398** | | -0.217 | | -0.221 | | -0.125 |
| | | (0.18) | | (0.15) | | (0.17) | | (0.16) |
| Constant | 0.244* | 0.179 | -0.189 | -0.192 | 0.238 | 0.206 | 0.248 | 0.258 |
| | (0.14) | (0.15) | (0.18) | (0.18) | (0.19) | (0.19) | (0.17) | (0.17) |
| Observations | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 |
| Dep. var. mean basic treatment | -0.014 | -0.014 | -0.008 | -0.008 | -0.008 | -0.008 | -0.007 | -0.007 |
| P-values | | | | | | | | |
| *Variation+Interaction=0* | | 0.154 | | 0.675 | | 0.607 | | 0.489 |
| *Random d.f.=Interaction* | | 0.055 | | 0.412 | | 0.293 | | 0.787 |
| *Variation=Interaction* | | 0.018 | | 0.081 | | 0.120 | | 0.065 |

*Notes*: Each column shows the estimated effect of the OLS regression of the outcome listed on variations on the basic treatment. For each outcome, two specifications are reported: the first with a variation on the treatment as the only independent variable and the second with an interaction between a variation on the treatment and being a random dairy farmer (see Table 11 notes for more details). The Knowledge and Adoption indexes are standardized weighted indexes of multiple indicator variables of the number of feed and dairy practices known or used in the last twelve months, as self-reported by farmers at midline and endline, constructed in line with Anderson (2008). Analysis restricted to sampled farmers in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

# A Appendix

## A.1 FT network module, baseline questionnaire

Each FT was asked to provide a list of socially connected dairy farmers with the following module. For each named person, the name, surname, gender and walking distance from the FT's home were collected. In total, the list cannot exceed 22 names. FTs were allowed to name the same person under different dimensions.

1. Is there any dairy farmer in the village who in the last 30 days has come to seek your advice on dairy farming? Or is there any dairy farmer in the village who in the past year has come to seek your advice on dairy farming? [*Ask for 5. If many, ask for those who have asked most frequently*]
2. Please list the five closest neighbors in the village who are dairy farmers (starting from the closest one).
3. Is there any dairy farmer in the village whom you can borrow money from in case of abrupt need? Max 2 names
4. Is there any dairy farmer in the village who can borrow money from you in case of abrupt need? Max 2 names
5. Is there any dairy farmer in the village to whom you talk at church? Max 2 names
6. Is there any dairy farmer in the village to whom in the last 30 days you have asked advice on dairy farming? Max 2 names
7. Is there any dairy farmer in the village from whom you think you can learn anything new in dairy farming? Max 2 names
8. Is there any dairy farmer in the village who can learn anything new from you in dairy farming? Max 2 names

## A.2 Identifying trainees belonging (or not) to the FT's first-degree social network

To match the FT's social network with the trainees, we use two sources of data. The first one are the attendance sheets filled out by FTs at every session; FTs had to write down the date of training and the name and surname of all trainees who took part to the session. These were then signed by each trainee. The second data source is the FTs' social network list collected at baseline (see Appendix A.1). For each FT we match these two data sources based on the farmers' names to recover information about the relationship between the trainees and the FTs.

Information contained on the attendance sheets was coded by the survey firm and we carefully cleaned the data (in particular the dates of training and trainees' names) by also relying on the paper-version of the original attendance sheets. We paid particular attention at avoiding duplicates of trainees' names due to misspelling errors. In total, attendance sheets contain 15306 unique trainees, while the FT's social network contain 6301 farmers.

The procedure of matching the 15306 trainees on the attendance sheets with the 6301 farmers in the FT's social network data was conducted in two steps. We match on names at the village level to identify trainees listed in the FT's social network.[27] We manage to match 2405 trainees, among which 862 have a perfect match (score equal to 1) with the FT's list. The rest of the 1543 trainees with a no-null score are manually checked. Out of the 2405, we confirm 1731 trainees who are part of the FT's social network. The rest of the trainees appearing on the attendance sheets are labeled as trainees sharing a "higher-degree" connection with the FT.

[27] We used the *reclink* command in the Stata 16 software.

## A.3 Appendix Tables

Table A1: Characteristics of farmer trainers in pure control group vs treatment group.

| | Pure control | | Treatment | | |
|---|---|---|---|---|---|
| | Mean | Sd | Mean | Sd | Diff |
| Male HHH | 0.96 | 0.19 | 0.94 | 0.23 | -0.02 |
| Age HHH | 42.54 | 11.53 | 42.23 | 12.09 | -0.31 |
| HHH attended school | 0.99 | 0.10 | 0.98 | 0.12 | -0.01 |
| Completed high school | 0.34 | 0.48 | 0.33 | 0.47 | -0.01 |
| Off-farm activity HHH | 0.70 | 0.46 | 0.67 | 0.47 | -0.03 |
| Household size | 8.22 | 3.79 | 7.98 | 4.07 | -0.25 |
| Nb. children in the household | 5.14 | 3.07 | 5.02 | 3.55 | -0.12 |
| FT most successful (share) | 0.17 | 0.22 | 0.18 | 0.24 | 0.02 |
| FT closest (share) | 0.21 | 0.21 | 0.21 | 0.21 | -0.00 |
| HH has/had member part of a committee | 0.40 | 0.49 | 0.37 | 0.48 | -0.03 |
| Prominence of FT | 1.48 | 0.86 | 1.44 | 0.90 | -0.04 |
| At least one prominence dimension | 0.87 | 0.34 | 0.84 | 0.36 | -0.03 |
| Uses a savings institution | 0.72 | 0.45 | 0.73 | 0.44 | 0.01 |
| Borrowed money from an institution | 0.52 | 0.50 | 0.51 | 0.50 | -0.01 |
| Nb. cows | 2.14 | 4.63 | 2.25 | 2.91 | 0.10 |
| Nb. heads of cattle | 5.85 | 10.64 | 6.40 | 8.38 | 0.55 |
| Produces milk | 0.74 | 0.44 | 0.83 | 0.38 | 0.09** |
| Average milk production per day | 3.06 | 4.55 | 3.82 | 5.22 | 0.77* |
| Sells milk | 0.39 | 0.49 | 0.45 | 0.50 | 0.06 |
| Nb. feed known | 8.85 | 2.08 | 8.82 | 2.15 | -0.03 |
| Nb. feed used | 4.98 | 1.57 | 4.79 | 1.53 | -0.18 |
| Nb. technologies known | 17.70 | 3.20 | 17.59 | 3.18 | -0.11 |
| Nb. technologies used | 8.82 | 2.69 | 8.64 | 2.63 | -0.18 |
| Land size in acres | 7.92 | 14.12 | 9.22 | 15.62 | 1.31 |
| Size of social network | 10.90 | 0.64 | 10.91 | 0.63 | 0.01 |
| Obs. | | | | | 604 |
| Joint F-test | | | | | 1.17 |
| p-value | | | | | 0.270 |

*Notes*: This table shows mean and standard deviations of farmer trainers' characteristics at baseline. Sample made of all farmer trainers in the treatment and pure control groups. The Diff column reports the regression coefficient of the treatment status for each single variable, with clustered standard errors at the village level. Stars indicate whether this difference is significantly different from zero.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Table A2: Characteristics of first-degree contacts versus higher-degree contacts.

| | **First-degree farmers** | | **Random dairy farmers** | | |
|---|---|---|---|---|---|
| | Mean | Sd | Mean | Sd | Diff |
| Male HHH | 0.90 | 0.30 | 0.91 | 0.28 | -0.01 |
| Age HHH | 46.89 | 14.06 | 45.70 | 12.87 | 1.26 |
| HHH attended school | 0.87 | 0.34 | 0.89 | 0.31 | -0.02 |
| Off-farm activity HHH | 0.47 | 0.50 | 0.46 | 0.50 | -0.02 |
| Household size | 8.90 | 4.22 | 8.22 | 3.72 | -0.49 |
| Nb. children in the household | 5.53 | 3.89 | 5.34 | 3.43 | -0.32 |
| Considers FT most successful farmer | 0.19 | 0.39 | 0.17 | 0.38 | -0.02 |
| Considers FT closest farmer | 0.23 | 0.42 | 0.14 | 0.35 | 0.04 |
| HH has/had member part of a committee | 0.34 | 0.48 | 0.29 | 0.45 | 0.00 |
| Uses a savings institution | 0.63 | 0.48 | 0.62 | 0.49 | 0.08** |
| Borrowed money from an institution | 0.46 | 0.50 | 0.39 | 0.49 | 0.05 |
| Nb. cows | 2.43 | 3.79 | 1.90 | 2.69 | -0.19 |
| Nb. heads of cattle | 6.65 | 8.57 | 5.42 | 6.99 | -0.49 |
| Produces milk | 0.84 | 0.37 | 0.79 | 0.41 | -0.00 |
| Average milk production per day | 3.09 | 4.40 | 2.53 | 4.69 | -0.09 |
| Sells milk | 0.44 | 0.50 | 0.38 | 0.49 | 0.02 |
| Nb. feed known | 7.75 | 2.11 | 7.72 | 2.03 | -0.25 |
| Nb. feed used | 3.68 | 1.84 | 3.60 | 1.92 | 0.37 |
| Nb. technologies known | 15.25 | 3.23 | 15.01 | 3.27 | -0.43 |
| Nb. technologies used | 6.74 | 2.88 | 6.47 | 3.07 | 0.19 |
| Land size in acres | 8.77 | 14.64 | 7.16 | 11.15 | 0.13 |
| Obs. | | | | | 1587 |
| Joint F-test | | | | | 1.06 |
| p-value | | | | | 0.395 |

*Notes:* This table shows mean and standard deviations of sampled farmers' characteristics measured at baseline. Sample made of sampled farmers in the treatment group. The Diff column reports the regression coefficient of each single variable on a dummy equal to one if the farmer was randomly picked and equal to zero if he/she belongs to the FT's first-degree contacts. Clustered standard errors at the village level. Stars indicate whether the difference is significantly different from zero.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A3: Descriptive statistics of FT's training activities and type of trainees.

| | ***Basic*** | ***Linkage*** | ***Signpost*** | ***Needs Assessment*** |
|---|---|---|---|---|
| | Mean | Mean | Mean | Mean |
| At least one session | 0.82 | 0.98 | 0.94 | 0.94 |
| | (0.39) | (0.12) | (0.24) | (0.23) |
| Nb. of sessions | 5.05 | 13.33 | 11.49 | 11.72 |
| | (5.45) | (8.66) | (9.04) | (9.23) |
| Nb. trainees | 22.16 | 43.25 | 41.32 | 37.32 |
| | (20.22) | (34.43) | (39.64) | (33.78) |
| Number of trainees per session | 6.48 | 5.96 | 5.86 | 5.71 |
| | (6.12) | (3.74) | (3.71) | (3.43) |
| Nb. trainees | 22.16 | 43.25 | 41.32 | 37.32 |
| | (20.22) | (34.43) | (39.64) | (33.78) |
| Share of trainees among close circle | 0.42 | 0.62 | 0.63 | 0.63 |
| | (0.37) | (0.34) | (0.33) | (0.34) |
| Share of first-degree trainees | 0.14 | 0.15 | 0.16 | 0.16 |
| | (0.16) | (0.11) | (0.14) | (0.12) |
| Share of higher-degree trainees | 0.68 | 0.83 | 0.78 | 0.79 |
| | (0.36) | (0.15) | (0.24) | (0.22) |
| Observations | 44 | 199 | 199 | 198 |

*Notes:* The variable "At least one session" is a dummy equal to 1 if FT held at least one training session. The variable "Nb. of sessions" is the number of sessions held by the FT during the time of the study. The variable "Nb. trainees" is the number of unique trainees measured on the attendance sheets for each FT. The variable "Number of trainees per session" is the number of trainees per session measured on the attendance sheets for each FT. The variable "Share of trainees in close circle" is the number of trainees among the first-degree sampled farmers appearing on the attendance sheets, divided by the number of FT's first-degree sampled farmers. The variable "Share of first-degree trainees" is the number of first-degree farmers listed in the FT's social network at baseline and appearing on the attendance sheets, divided by the number of first-degree farmers listed in the FT's social network. The variable "Share of higher-degrees trainees" is the number of farmers appearing on the attendance sheets but not in the FT's social network, divided by the number of trainees on the attendance sheets at the FT-level.

Table A4: Sample composition by treatment assignment.

| **Group** | **Farmer trainers** | **Sampled farmers** |
|---|---|---|
| Control | 216 | 859 |
| Basic treatment | 50 | 198 |
| One variation | 162 | 644 |
| Two variations | 146 | 583 |
| Three variations | 53 | 211 |
| Linkage | 206 | 821 |
| Needs Assessment | 203 | 808 |
| Signpost | 204 | 814 |

*Notes:* This table shows the number of farmer trainers and sampled farmers assigned to the pure control group, to the basic treatment group, to one, two or three treatment variations, and to each type of treatment variation.

Table A5: Dimensions of FT prominence by treatment variation.

| | ***Basic*** | ***Linkage*** | ***Needs A.*** | ***Signpost*** |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| N. SF considering FT most successful | 0.77 | 0.69 | 0.72 | 0.66 |
| | (0.96) | (0.94) | (0.96) | (0.91) |
| N. SF considering FT closest | 0.68 | 0.82 | 0.84 | 0.84 |
| | (0.74) | (0.81) | (0.86) | (0.84) |
| SF considering FT most successful | 0.20 | 0.18 | 0.19 | 0.17 |
| | (0.24) | (0.24) | (0.25) | (0.23) |
| SF considering FT closest | 0.18 | 0.21 | 0.22 | 0.21 |
| | (0.19) | (0.21) | (0.23) | (0.22) |
| At least one SF considering FT most successful | 0.52 | 0.45 | 0.45 | 0.44 |
| | (0.51) | (0.50) | (0.50) | (0.50) |
| At least one SF considering FT closest | 0.55 | 0.60 | 0.59 | 0.60 |
| | (0.50) | (0.49) | (0.49) | (0.49) |
| HH has/had member part of a committee | 0.36 | 0.37 | 0.38 | 0.33 |
| | (0.49) | (0.48) | (0.49) | (0.47) |
| Observations | 44 | 199 | 198 | 199 |

*Notes:* The variables "N. SF considering FT most successful", "N. SF considering FT closest", "SF considers FT most successful", "SF considers FT closest", "At least one SF considers FT most successful" and "At least one SF considers FT closest" are measured for each FT using baseline survey data declared by sampled farmers (SF) whether they consider the FT as the most successful or the geographically closest dairy farmer. The variable "HH has/had member in committee " is a dummy equal to one if at least one FT's household member (including the FT) was or is part of a local committee at the village/parish/district level.

Table A6: Effects on FTs' training activities by treatment variation.

| | (1) **At least one session** | (2) **Nb. sessions** | (3) **Nb. trainees** | (4) **Nb. trainees per session** |
|---|---|---|---|---|
| Variation | 0.129** | 6.578*** | 18.930*** | -0.421 |
| | (0.06) | (1.01) | (4.06) | (0.95) |
| Constant | 0.817*** | 2.333 | 11.129 | 6.337*** |
| | (0.08) | (1.79) | (7.48) | (1.35) |
| Linkage | 0.108*** | 5.050*** | 11.502*** | 0.041 |
| | (0.02) | (0.83) | (3.32) | (0.42) |
| Constant | 0.890*** | 6.290*** | 23.843*** | 5.924*** |
| | (0.06) | (1.54) | (7.07) | (0.99) |
| Signpost | 0.018 | 1.410 | 7.638* | -0.278 |
| | (0.03) | (0.88) | (3.41) | (0.42) |
| Constant | 0.928*** | 7.707*** | 24.579*** | 6.098*** |
| | (0.07) | (1.69) | (6.58) | (0.99) |
| Needs Assessment | 0.029 | 2.019** | -0.112 | -0.461 |
| | (0.03) | (0.87) | (3.40) | (0.42) |
| Constant | 0.917*** | 7.112*** | 28.952*** | 6.259*** |
| | (0.06) | (1.68) | (6.95) | (0.99) |
| Observations | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 0.82 | 5.05 | 22.16 | 6.48 |
| P-values | | | | |
| *Linkage = Signpost* | 0.01 | 0.00 | 0.43 | 0.60 |
| *Linkage = Needs Assessment* | 0.01 | 0.00 | 0.00 | 0.35 |
| *Signpost= Needs Assessment* | 0.76 | 0.61 | 0.10 | 0.72 |

*Notes*: Each column shows the estimated effect of the OLS regression of the outcome listed at the top of the column on variations to the basic treatment.The first part of the Table shows the ITT results of being assigned to one of the treatment variations compared to the basic treatment. The rest of the Table reports the results for each single treatment variation. "At least one session" is a dummy equal to one if the FT ever organized a training session after baseline data collection. "N.sessions" is the overall number of training sessions organized by an FT. "N. trainees" is the number of unique trainees trained by each FT. "N. trainees per session" is the ratio of the number of unique trainees over the number of sessions organized. All outcomes are measured with the attendance sheets at the FT level. Analysis limited to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A7: Effect on accessing extension agents, by variation.

| | (1)<br>**EA visit** | (2)<br>**EA visits** | (3)<br>**EA led training** | (4)<br>**EA visit** | (5)<br>**EA visits** | (6)<br>**EA led training** |
|---|---|---|---|---|---|---|
| Variation | 0.369*** | 4.551*** | 0.185*** | 0.448*** | 4.800*** | 0.099 |
| | (0.07) | (0.48) | (0.06) | (0.11) | (0.77) | (0.09) |
| Had a contact with an EA at baseline | | | | 0.153 | 0.148 | -0.048 |
| | | | | (0.14) | (0.71) | (0.11) |
| Variation x Contact with EA at baseline | | | | -0.129 | -0.409 | 0.142 |
| | | | | (0.14) | (0.96) | (0.11) |
| Constant | 0.217 | 1.421 | 0.202 | 0.138 | 1.237 | 0.265* |
| | (0.14) | (1.81) | (0.13) | (0.15) | (1.80) | (0.14) |
| Linkage | 0.471*** | 6.704*** | 0.256*** | 0.420*** | 6.427*** | 0.236*** |
| | (0.04) | (0.48) | (0.04) | (0.07) | (0.85) | (0.06) |
| Had a contact with an EA at baseline | | | | 0.005 | -0.280 | 0.066 |
| | | | | (0.07) | (0.46) | (0.05) |
| Linkage x Contact with EA at baseline | | | | 0.086 | 0.455 | 0.037 |
| | | | | (0.09) | (1.06) | (0.08) |
| Constant | 0.357** | 2.754 | 0.263* | 0.367** | 2.871 | 0.255* |
| | (0.11) | (1.70) | (0.11) | (0.11) | (1.74) | (0.11) |
| Signpost | 0.057 | 0.177 | -0.018 | 0.069 | -0.078 | -0.088 |
| | (0.05) | (0.59) | (0.04) | (0.08) | (1.00) | (0.07) |
| Had a contact with an EA at baseline | | | | 0.046 | -0.436 | 0.025 |
| | | | | (0.07) | (0.84) | (0.07) |
| Signpost x Contact with EA at baseline | | | | -0.021 | 0.431 | 0.112 |
| | | | | (0.10) | (1.25) | (0.09) |
| Constant | 0.530*** | 5.588** | 0.385** | 0.516*** | 5.786** | 0.413** |
| | (0.13) | (1.85) | (0.13) | (0.14) | (1.90) | (0.13) |
| Needs Assessment | 0.043 | 0.629 | 0.018 | 0.129* | 0.782 | -0.003 |
| | (0.05) | (0.60) | (0.04) | (0.08) | (1.04) | (0.07) |
| Had a contact with an EA at baseline | | | | 0.108 | -0.085 | 0.061 |
| | | | | (0.07) | (0.89) | (0.06) |
| Need Assessment x Contact with EA at baseline | | | | -0.140 | -0.257 | 0.036 |
| | | | | (0.10) | (1.28) | (0.09) |
| Constant | 0.533*** | 5.255*** | 0.362*** | 0.471*** | 5.198** | 0.361*** |
| | (0.13) | (1.96) | (0.13) | (0.14) | (2.13) | (0.13) |
| Observations | 395 | 395 | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 0.34 | 0.82 | 0.11 | 0.34 | 0.82 | 0.11 |

*Notes :* Columns 1-3 present estimated effect of the treatment variations on a set of variables about EA's presence at training sessions. Columns 4-6 present the same regressions but include the interaction term between the treatment assignment and baseline contact with an EA. The first part of the Table shows the ITT results of being assigned to one of the treatment variations compared to the basic treatment. The rest of the Table reports the results for each single treatment variation. Analysis limited to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. Controls for strata fixed effects included. Robust standard errors clustered at the village level in parentheses.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A8: Effects on the advantages of accessing an extension agent, by variation.

| | $\beta$ | **Const.** | **Mean dep. var.** | **N** |
|---|---|---|---|---|
| ***Panel A: Linkage*** | | | | |
| N. advantages receiving EA (FT) | 0.677*** | 0.426*** | 0.360 | 395 |
| | $(0.06)^{s,n}$ | (0.04) | | |
| N. advantages FT receiving EA (SF) | 0.057** | 0.248*** | 0.180 | 1596 |
| | (0.03) | (0.02) | | |
| ***Panel B: Sign-post*** | | | | |
| N. advantages receiving EA (FT) | 0.089 | 0.722*** | 0.360 | 395 |
| | $(0.07)^{l}$ | (0.05) | | |
| N. advantages FT receiving EA (SF) | 0.037 | 0.258*** | 0.180 | 1596 |
| | (0.03) | (0.02) | | |
| ***Panel C: Needs Assessment*** | | | | |
| N. advantages receiving EA (FT) | 0.029 | 0.752*** | 0.360 | 395 |
| | $(0.07)^{l}$ | (0.05) | | |
| N. advantages FT receiving EA (SF) | 0.013 | 0.270*** | 0.180 | 1596 |
| | (0.03) | (0.02) | | |

*Notes*: Each row shows the estimated effect of the treatment variations on the outcome listed in the left column. "N. advantages receiving EA (FT)" and "N. advantages receiving EA (SF)" are categorical variables summing the advantages about receiving the visit of an extension agent (EA) measured at midline and endline reported by FTs and SFs (sampled farmers). Panel A shows results of the "Linkage" variation. Panel B shows results of the "Signpost" variation. Panel C shows results of the "Needs Assessment" variation. Analysis limited to FTs and sampled farmers in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.

Indexes $l$, $s$, $n$ indicate significant differences between estimated coefficients across variations with p-values at least below 10% ($l$ = if significantly different from Linkage; $s$ = if significantly different from Signpost; $n$ = if significantly different from Needs Assessment).

* p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Table A9: Effects on farmers' opinions about the quality of training.

| | FT's advice is appropriate | | FT's advice is helpful | | FT customizes information | | FT distributes seeds | | FT demonstrates practices | | FT knowledgeable in feeding practices | | N. topics discussed during visits | | Index quality trainings and advice | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| Variation | 0.040 | | 0.068* | | 0.048 | | 0.089*** | | 0.067 | | -0.014 | | 0.050 | | 0.122** | |
| | (0.03) | | (0.04) | | (0.05) | | (0.03) | | (0.06) | | (0.02) | | (0.03) | | (0.05) | |
| Variation=1 | | 0.038 | | 0.071 | | 0.087 | | 0.112*** | | 0.108* | | -0.006 | | 0.071* | | 0.164*** |
| | | (0.03) | | (0.04) | | (0.05) | | (0.03) | | (0.06) | | (0.02) | | (0.04) | | (0.05) |
| Random dairy farmer=1 | | -0.071 | | -0.009 | | 0.040 | | 0.002 | | 0.073 | | 0.054 | | -0.002 | | 0.015 |
| | | (0.07) | | (0.08) | | (0.08) | | (0.05) | | (0.11) | | (0.05) | | (0.08) | | (0.08) |
| Variation=1 × Random dairy farmer=1 | | 0.008 | | -0.009 | | -0.158* | | -0.094 | | -0.189 | | -0.031 | | -0.082 | | -0.171* |
| | | (0.07) | | (0.08) | | (0.08) | | (0.06) | | (0.12) | | (0.05) | | (0.08) | | (0.09) |
| Constant | 0.842*** | 0.860*** | 0.621*** | 0.624*** | 0.327*** | 0.318*** | 0.034 | 0.035 | 0.457*** | 0.438*** | 0.058* | 0.045 | 0.206*** | 0.206*** | -0.115 | -0.119 |
| | (0.05) | (0.05) | (0.08) | (0.09) | (0.08) | (0.08) | (0.05) | (0.05) | (0.11) | (0.11) | (0.03) | (0.03) | (0.06) | (0.06) | (0.10) | (0.10) |
| Observations | 1596 | 1596 | 1596 | 1596 | 1561 | 1561 | 1561 | 1561 | 1094 | 1094 | 1596 | 1596 | 1596 | 1596 | 1596 | 1596 |
| Dep. var. mean basic treatment | 0.872 | 0.872 | 0.665 | 0.665 | 0.404 | 0.404 | 0.094 | 0.094 | 0.509 | 0.509 | 0.050 | 0.050 | 0.229 | 0.229 | -0.022 | -0.022 |
| P-values | | | | | | | | | | | | | | | | |
| *Variation+Interaction=0* | | 0.455 | | 0.422 | | 0.380 | | 0.721 | | 0.463 | | 0.412 | | 0.869 | | 0.939 |
| *Random d.f.=Interaction* | | 0.549 | | 0.995 | | 0.217 | | 0.383 | | 0.245 | | 0.363 | | 0.601 | | 0.267 |
| *Variation=Interaction* | | 0.726 | | 0.451 | | 0.034 | | 0.010 | | 0.053 | | 0.670 | | 0.152 | | 0.005 |

*Notes*: Each column shows the estimated effect of the treatment variations on the outcome listed in the left column. "Index quality training and advice" is a standardized index computed as the sum of Z-scores of variables specified in the first 14 columns; it is normalized relative to the basic treatment group. Random dairy farmers are sample farmers absent from the FT's list of first-degree contacts and randomly picked from the village list of dairy farmers. "Variation" is a dummy variable equal to one for farmers living in villages assigned to one of the three treatment variations and equal to zero for farmers in villages assigned to the basic treatment group. Analysis limited to FTs and sampled farmers in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A10: Robustness check for multiple hypothesis testing on FTs' training activities. Romano-Wolf p-values.

| | Model p-values | | | | RW p-values | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | All variations | Linkage | Signpost | Needs A. | All variations | Linkage | Signpost | Needs A. | Obs |
| Nb. trainees | 0.00 | 0.00 | 0.03 | 0.97 | 0.01 | 0.00 | 0.09 | 0.98 | 395 |
| Share of trainees in close circle | 0.00 | 0.03 | 0.01 | 0.03 | 0.02 | 0.05 | 0.07 | 0.12 | 395 |
| Share of first-degree trainees | 0.51 | 0.75 | 0.14 | 0.65 | 0.49 | 0.76 | 0.25 | 0.88 | 395 |
| Share of higher-degree trainees | 0.04 | 0.00 | 0.92 | 0.36 | 0.05 | 0.00 | 0.92 | 0.73 | 395 |

*Notes*: This Table reports the p-values estimated with the standard OLS regression (columns 1-4), the results of which are reported in Table 5, and the Romano-Wolf adjusted p-values with 1000 replications (columns 5-8). Each column reports the results for all the three variations or for each variation separately. Each row refers to a different outcome variable listed on the first column. Analysis limited to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. See notes of Table 5 for the outcomes definition.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A11: Robustness check with a Lasso specification to control for FT's characteristics.

| | $\beta$ | **Lasso Controls.** | **N** |
|---|---|---|---|
| ***Panel A: All variations*** | | | |
| Nb. trainees | 18.997***<br>(4.08) | 22.159 | 384 |
| Share of trainees in close circle | 0.202***<br>(0.06) | 0.424 | 384 |
| Share of first-degree trainees | 0.016<br>(0.03) | 0.135 | 384 |
| Share of higher-degree trainees | 0.108**<br>(0.05) | 0.683 | 384 |
| ***Panel B: Linkage*** | | | |
| Nb. trainees | 12.081***<br>(3.34) | 22.159 | 384 |
| Share of trainees in close circle | 0.084*<br>(0.03) | 0.424 | 384 |
| Share of first-degree trainees | -0.003<br>(0.01) | 0.135 | 384 |
| Share of higher-degree trainees | 0.109***<br>(0.02) | 0.683 | 384 |
| ***Panel C: Sign-post*** | | | |
| Nb. trainees | 7.417*<br>(3.50) | 22.159 | 384 |
| Share of trainees in close circle | 0.089*<br>(0.04) | 0.424 | 384 |
| Share of first-degree trainees | 0.021<br>(0.01) | 0.135 | 384 |
| Share of higher-degree trainees | 0.000<br>(0.03) | 0.683 | 384 |
| ***Panel D: Needs Assessment*** | | | |
| Nb. trainees | 0.560<br>(3.41) | 22.159 | 384 |
| Share of trainees in close circle | 0.105**<br>(0.04) | 0.424 | 384 |
| Share of first-degree trainees | 0.004<br>(0.01) | 0.135 | 384 |
| Share of higher-degree trainees | 0.023<br>(0.03) | 0.683 | 384 |

*Notes:* Each row shows the estimated effect of the treatment variations on the outcome listed in the left column with a Lasso specification to control for FT's characteristics. Analysis limited to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. See notes of Table 5 for the outcomes definition.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A12: Robustness check to control for unbalanced covariates.

| | $\beta$ | **Const.** | **Mean dep. var.** | **N** |
|---|---|---|---|---|
| ***Panel A: All variations*** | | | | |
| Nb. trainees | 19.491*** | -1.496 | 22.159 | 395 |
| | (4.06) | (30.49) | | |
| Share of trainees in close circle | 0.196*** | -0.158 | 0.424 | 395 |
| | (0.06) | (0.28) | | |
| Share of first-degree trainees | 0.017 | 0.232 | 0.135 | 395 |
| | (0.03) | (0.15) | | |
| Share of higher-degree trainees | 0.113** | 0.741*** | 0.683 | 395 |
| | (0.06) | (0.15) | | |
| ***Panel B: Linkage*** | | | | |
| Nb. trainees | 11.657*** | 15.057 | 22.159 | 395 |
| | (3.32) | (27.15) | | |
| Share of trainees in close circle | 0.072* | 0.024 | 0.424 | 395 |
| | (0.03) | (0.28) | | |
| Share of first-degree trainees | -0.004 | 0.252 | 0.135 | 395 |
| | (0.01) | (0.15) | | |
| Share of higher-degree trainees | 0.113*** | 0.821*** | 0.683 | 395 |
| | (0.02) | (0.13) | | |
| ***Panel C: Sign-post*** | | | | |
| Nb. trainees | 7.726* | 18.266 | 22.159 | 395 |
| | (3.38) | (31.50) | | |
| Share of trainees in close circle | 0.079* | 0.040 | 0.424 | 395 |
| | (0.04) | (0.26) | | |
| Share of first-degree trainees | 0.021 | 0.248 | 0.135 | 395 |
| | (0.01) | (0.15) | | |
| Share of higher-degree trainees | -0.002 | 0.861*** | 0.683 | 395 |
| | (0.03) | (0.14) | | |
| ***Panel D: Needs Assessment*** | | | | |
| Nb. trainees | 0.063 | 19.142 | 22.159 | 395 |
| | (3.39) | (30.82) | | |
| Share of trainees in close circle | 0.086* | 0.006 | 0.424 | 395 |
| | (0.04) | (0.28) | | |
| Share of first-degree trainees | 0.007 | 0.247 | 0.135 | 395 |
| | (0.01) | (0.15) | | |
| Share of higher-degree trainees | 0.023 | 0.849*** | 0.683 | 395 |
| | (0.03) | (0.15) | | |

*Notes:* Each row shows the estimated effect of the treatment variations on the outcome listed in the left column, while controlling for unbalanced covariates between FTs in the basic treatment group and in the treatment variations. Analysis limited to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level. See notes of Table 5 for the outcomes definition.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A13: Robustness check controlling for treatments interactions on FTs' training activities and the type of trainees.

| | (1)<br>**At least one session** | (2)<br>**Nb. sessions** | (3)<br>**Nb. trainees** | (4)<br>**Nb. trainees per session** | (5)<br>**Share of trainees in close circle** | (6)<br>**Share of first-degree trainees** | (7)<br>**Share of higher-degree trainees** |
|---|---|---|---|---|---|---|---|
| Linkage | 0.173*** | 7.613*** | 25.684*** | 0.716 | 0.156** | -0.007 | 0.179*** |
| | (0.06) | (1.49) | (5.35) | (1.18) | (0.08) | (0.03) | (0.06) |
| Signpost | 0.068 | 4.204*** | 16.207** | -0.628 | 0.079 | 0.034 | 0.034 |
| | (0.07) | (1.35) | (6.55) | (1.09) | (0.07) | (0.03) | (0.07) |
| Needs Assessment | 0.050 | 3.846** | 8.097* | -0.922 | 0.175** | 0.003 | 0.047 |
| | (0.08) | (1.56) | (4.91) | (1.08) | (0.08) | (0.03) | (0.07) |
| Linkage x Signpost | -0.076 | -4.356** | -17.057* | -0.639 | 0.068 | -0.014 | -0.062 |
| | (0.07) | (2.02) | (8.82) | (1.42) | (0.10) | (0.04) | (0.07) |
| Linkage x Need Assessment | -0.049 | -3.498 | -17.834** | -0.447 | -0.157 | 0.023 | -0.072 |
| | (0.08) | (2.28) | (7.30) | (1.35) | (0.10) | (0.04) | (0.08) |
| Need Assessment x Signpost | 0.000 | -3.351 | -6.608 | 1.676 | 0.054 | -0.012 | 0.012 |
| | (0.10) | (2.31) | (9.02) | (1.38) | (0.10) | (0.04) | (0.09) |
| Linkage x Need Assessment x Signpost | -0.131 | -5.440* | -25.125** | -0.033 | -0.190 | -0.006 | -0.125 |
| | (0.13) | (3.02) | (11.80) | (2.17) | (0.15) | (0.06) | (0.13) |
| Constant | 0.820*** | 2.455 | 11.548 | 6.258*** | 0.360*** | 0.153*** | 0.667*** |
| | (0.08) | (1.72) | (7.30) | (1.38) | (0.09) | (0.05) | (0.09) |
| Control for interaction | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 395 | 395 | 395 | 395 | 395 | 395 | 395 |
| Mean for basic treatment group | 0.82 | 5.05 | 22.16 | 6.48 | 0.42 | 0.14 | 0.68 |
| P-values | | | | | | | |
| *Linkage = Signpost* | 0.010 | 0.031 | 0.160 | 0.143 | 0.250 | 0.138 | 0.001 |
| *Linkage = Needs Assessment* | 0.017 | 0.025 | 0.001 | 0.075 | 0.802 | 0.693 | 0.006 |
| *Signpost=Needs Assessment* | 0.782 | 0.824 | 0.201 | 0.704 | 0.148 | 0.295 | 0.826 |
| *Linkage= Linkage x Signpost* | 0.047 | 0.000 | 0.001 | 0.589 | 0.599 | 0.913 | 0.045 |
| *Linkage = Linkage x Needs Assessment* | 0.087 | 0.002 | 0.000 | 0.635 | 0.065 | 0.625 | 0.041 |
| *Signpost = Signpost x Linkage* | 0.307 | 0.006 | 0.021 | 0.996 | 0.946 | 0.497 | 0.474 |
| *Signpost= Signpost x Needs Assessment* | 0.660 | 0.023 | 0.118 | 0.327 | 0.875 | 0.523 | 0.877 |
| *Needs Assessment = Needs Assessment x Linkage* | 0.525 | 0.039 | 0.021 | 0.837 | 0.048 | 0.750 | 0.406 |
| *Needs Assessment= Need Assessment x Signpost* | 0.761 | 0.043 | 0.238 | 0.266 | 0.466 | 0.829 | 0.815 |
| *Linkage= Linkage x Signpost x Needs Assessment* | 0.105 | 0.002 | 0.001 | 0.818 | 0.111 | 0.989 | 0.085 |
| *Signpost= Linkage x Signpost x Needs Assessment* | 0.314 | 0.017 | 0.016 | 0.851 | 0.196 | 0.665 | 0.391 |
| *Needs Assessment= Linkage x Signpost x Needs Assessment* | 0.380 | 0.030 | 0.031 | 0.778 | 0.091 | 0.923 | 0.368 |

*Notes*: Each column shows the estimated effect of the treatment variations interacted with the other treatments on a set of outcomes. "At least one session" is a dummy equal to one if the FT ever held a training session after baseline data collection. "Nb.sessions" is the total number of training sessions given by an FT. "Nb. trainees" is the number of separate trainees trained by each FT. "Nb. trainees per session" is the ratio of the number of separate trainees to the number of sessions held. Outcomes in columns 1-4 are measured from the attendance sheets at the FT level. For outcomes in columns 5-7, see Table 5 notes. Analysis restricted to FTs in the treatment group. Each regression includes strata fixed effects, and robust standard errors clustered at the village level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.