# Back from Israel:

# The Causal Impacts of Training in Modern Farms

# on Smallholder Cultivation in Nepal

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PRELIMINARY DRAFT. DO NOT CIRCULATE

Abstract

What are the effects of agricultural knowledge transfer on smallholder farmers? Experimental or quasi-experimental evaluations of agricultural extensions programs remain scant. Moreover, such programs are known to suffer from deep implementation flaws, making it difficult to assess whether low impacts are observed because of poor implementation or because knowledge is not in fact the binding constraint to adoption of improved practices. We utilize a unique natural experiment, in which Nepali smallholder farmers are selected by lottery to take part in a year long agricultural training and employment in Israel. Upon their return to Nepal, participants are more likely to engage in market oriented agriculture and invest in cultivation. However, investments in costly, transformative technologies remain low, meaning that most participants are unable to fully implement what they have learnt in Israel.

Keywords: Agriculture, Extension, Technology Adoption, Learning, Migration

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## Introduction

To what extent can the absence of knowledge of and training in improved agricultural technologies explain their low rate of adoption by farmers in developing countries? A growing empirical literature in development economics (Foster and Rozenweig, 2010) investigates the multiple potential barriers to adoption, including lack of access to credit and insurance (e.g. Karlan et al, 2014), behavioral factors (e.g Duflo et al, 2011), and the possibility that technologies are not in fact as profitable as one assumes (Suri, 2011).

Several studies are also focused on the effects of learning from one's peers (e.g. (Foster and Rosenzweig, 1995; Conley and Udry, 2010; Beaman et al, 2014; Ben Yishay and Mobarak, 2015), but experimental evaluations of extension and training programs, which are ubiquitous in developing countries, remain few (Feder, Lau, and Slade (1959), Anderson and Feder (2007), Gandhi, Veeraraghavan, Toyama, and Ramprasad (2009), Duflo, Kremer, and Robinson (2011), Birkhaeuser, Evenson, and Feder (1991), Bardhan and Mookherjee (2011), Cole and Fernando (2012)). Moreover, when extension programs are evaluated and found to have low returns, this does not necessarily suggest knowledge is not a critical barrier, because it may simply be that these programs are not designed and carried out effectively. In fact, there is a wide consensus among scholars that most extension and training programs in developing countries are poorly executed, and the reasons for that have much to do with the economic environment in which they are implemented in developing countries (e.g. difficulty of physical access, low incentives, and lack of monitoring).

In this paper, we provide new evidence on the impacts of training and extension by taking advantage of a unique natural experiment in which smallholder farmers from Nepal, one of the poorest countries in the world, are randomly selected to participate in an intensive 1-year training and work program in Israeli farms, which are some of the most efficient and productive farms in the world. The exposure and experience gained by these farmers is more modern and practical than any they would realistically be able to gain through typical training programs or in their home country. Moreover, the theoretical and practical training offered by

employers is motivated by commercial drivers. In fact, the program is entirely self-financed by the participants' labor, who also receive a modest salary.

By observing participants back in Nepal, upon their return, we can attempt to learn to what extent this kind of extension programs allows them to implement what they have learnt in their own land, or whether. Success would provide indications that effective training programs (with some modest finance gained through their earnings in Israel) do have the capacity to transform smallholder agriculture in developing countries.

Preliminary results from three rounds of surveys (N=959) indicates that in comparison to candidates who did not win the lottery, program participants are somewhat more likely to practice cultivation. They are more likely to engage in commercial agriculture (own agriculture businesses) and to invest in their farms. At the same time, investments in costly, modern technologies remain low, indicating only a fraction of participants are able to implement what they had learnt in Israel.

**Background**

Over the past 20 years Israel has harnessed its vast agricultural expertise and created the "International Agricultural Internship Project" as a unique training program. The project has hosted thousands of students from over 15 Asian and African countries and is run in cooperation with the Israeli Ministries of Interior, Agriculture, and Foreign Affairs (including MAHSAV, Israel's Agency for International Development Cooperation). This is a longstanding project that works at two levels: (1) state level of establishing strategic international connections between the State of Israel with other nations, and (2) making advanced Israeli knowhow in the field of agriculture accessible for students from developing countries. Six independent training centers currently exist within Israel and work with different countries; all are under the auspices of MASHAV, and in cooperation with Israeli embassies.

Five Israeli centers currently host agricultural training programs for students from Nepal. The programs are 10-11 months in duration and formally expose students to advanced agriculture over 40-45 study days and informally through paid work in

the field throughout their time in Israel. Participants earn a salary consisting of US$6-10,000 that they take back to their countries with them at the end of their stay. As far as is known to the researchers, this project is unique to Israel. We have not found a similar example in which a group of young farmers receive long-term training in a different country, are provided with financial credit and exposure to advanced agricultural technologies and methods and are then returned to their home country.

Despite the long existence of the International Agricultural Internship Project no baseline or end-line data have been collected on the participants and it is difficult to gage the effectiveness of the program in a larger development context.

In recent years a special selection process for the program was developed in Nepal, which can facilitate evaluation of the program's impacts. In an effort to avoid corruption, in 2013 the Israeli Embassy in Nepal re-established the selection process of the program, and picked a new program partner, a Grameen-style cooperative bank, Sana Kisan Bikas Bank Ltd (SKBBL), Nepali for "Small Farmers Development Bank" (henceforth referred to as "the Bank"). The Bank works with individual Small Farmer Agriculture Cooperative Ltd (SFACL, henceforth referred to as "cooperatives"), a network of grassroots level cooperatives of rural small farmer which are owned and managed by the local community.

All candidates are now chosen through a transparent lottery selection process, designed by the Israeli Embassy in Nepal and the Sana Kisan Bikas Bank. The sample in this preliminary report includes 959 candidates who joined the lottery process between the years 2013-2016.

Candidates all follow similar eligibility criteria:

1. Candidate must be from the cooperatives member family who are associated with the cooperative for at least one year back.
2. Their family possesses very good and acceptable track records with the cooperative.
3. The main occupation of the family is agriculture and the candidate is helping their family in agriculture works.

4. Candidate has passed grade 12 is between 22-30 years old. The parents and candidate declare their commitment to participate in this program and also promise to follow the rules and regulation of the Bank and cooperatives regarding this program.

Once all the candidates have applied, a random lottery takes place in each region. An Israeli representative from the training center comes to Nepal to conduct interviews and selects 1/3 of the total candidates.

**Data and Empirical Approach**

Since the program's current inception in 2013, the Bank has kept diligent tracking records for the potential and accepted candidates in its program. Due to the nature of the selection process of candidates to the program, a natural randomized control trial has been put in place, allowing us to compare candidates who won the lottery (treatment group) with those who did not (control group).

The data used for this study was collected in three waves between the years 2016-2019. In the analysis process, the data for the three waves were pooled together. In total, the sample contains 959 observations. Our treatment variable is based on the results of the lottery, rather than on actually joining the program (intent to treat). Our sample contains interns in two Israeli training centers (Kinneret and AICAT). Candidates are assigned in advance to one of the training centers (and hence, to one of the lotteries), mostly according to their region of residence in Nepal. Table 1 presents information about the three waves of data collection.

Table 1: Sample Structure

| Wave # | Lottery year | Survey year | Number of observations | Won lottery (Treatment group) | Candidates for training center | |
|---|---|---|---|---|---|---|
| | | | | | AICAT | KINNERET |
| **1** | 2013 & 2014 | 2016 | 446 | 223 | 60 | 386 |
| **2** | 2015 | 2017 | 270 | 144 | 0 | 270 |
| **3** | 2016 | 2019 | 243 | 123 | 44 | 199 |
| **Total** | | | 959 | 490 | 104 | 855 |

Table 2 reports comparisons of variables that could not have been affected by the program, and thus serve to examine the balance between the control and treatment groups. The candidate's caste groups and age appear to be balanced. Recalled assets holding tree or four years back, while subject to potential measurement error associated with recall bias, also appears overall balanced, although treatment households are slightly more likely to have owned land.

Table 2: Balance

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| **Caste type** | | | | | |
| Adibasi / Janajati | 0.13 | 0.14 | -0.00 | 0.02 | 0.84 |
| Brahman | 0.45 | 0.45 | 0.00 | 0.03 | 0.93 |
| Chhetri | 0.19 | 0.18 | 0.01 | 0.03 | 0.62 |
| Other caste | 0.22 | 0.23 | -0.01 | 0.03 | 0.69 |
| Candidate's current age | 27.32 | 27.44 | -0.12 | 0.21 | 0.57 |
| **Asset ownership (3 to 4 years prior to survey)** | | | | | |
| Land (yes / no) | 0.98 | 1.00 | -0.01 | 0.01 | 0.05 |
| House type: pakka (yes/no) | 0.41 | 0.40 | 0.00 | 0.03 | 0.92 |
| Tractor (yes / no) | 0.04 | 0.05 | -0.01 | 0.01 | 0.42 |
| Plough (yes / no) | 0.50 | 0.49 | 0.02 | 0.03 | 0.63 |
| Water pump (yes / no) | 0.61 | 0.64 | -0.03 | 0.03 | 0.32 |
| Generator (yes / no) | 0.03 | 0.03 | 0.00 | 0.01 | 0.76 |
| Green/net house (yes / no) | 0.00 | 0.01 | -0.01 | 0.00 | 0.20 |
| Sprinkler/drip (yes / no) | 0.06 | 0.07 | -0.01 | 0.02 | 0.73 |
| Number of cows/buffaloes | 2.54 | 2.67 | -0.13 | 0.14 | 0.35 |
| Number of goats | 4.75 | 4.85 | -0.10 | 0.28 | 0.73 |
| Number of pigs | 0.56 | 0.46 | 0.11 | 0.16 | 0.51 |
| Observations | 959 | | | | |

Each row reports comparisons of means of the variables mentioned on the left hand side between the control (did not win the lottery) and treatment (won the lottery) group (`intent to treat' estimates). Columns 1 and 2 report mean values in the control and treatment group, respectively. Column 3 reports the estimated difference, and columns 4 and 5 report its standard error and the p-value. The sample consists of 959 individuals.

Not all lottery winners end up traveling to Israel, as some drop out for various reasons, such as making poor impressions in interviews or failing to pass an health examination. Similarly, some candidates who failed the lottery apply again or in rare cases, recruited out of waiting lists. Overall, 75% of lottery winners ended up going to Israel, and 16% of losers did as well (Table 3). Because of this imperfect compliance, all estimates reported below are based on a comparison of lottery winners and losers (intent-to-treat estimates).

Table 3: Compliance

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| Candidate ever applied to the lottery | 1.00 | 0.99 | 0.00 | 0.00 | 0.69 |
| Candidate went to Israel | 0.16 | 0.75 | -0.59 | 0.03 | 0.00 |
| Observations | 957 | | | | |
| Each row reports comparisons of means of the variables mentioned on the left hand side between the control (did not win the lottery) and treatment (won the lottery) group (`intent to treat' estimates). Columns 1 and 2 report mean values in the control and treatment group, respectively. Column 3 reports the estimated difference, and columns 4 and 5 report its standard error and the p-value. The sample consists of 959 individuals. | | | | | |

## Results

**Employment**. We begin by comparing, in Table 4, main sources of employment and places of residence, segregated by seasons: the dry season, or summer, which lasts approximately from April to June, the rainy season, which lasts from June to October, and the winter season, which lasts from October to March.

Results indicate that treated farmers are 7%-8% more likely to be engaged in cultivation for their main source of income in the rainy and winter season. During the dry (summer) season, which is less suitable for agriculture, cultivation rates drop dramatically in both groups, to an extent that there is no significant difference between them. Control farmers, in contrast, appear to be more likely to be employed in private sector firms. Likely related to this, the likelihood of residence in the home-village during the dry and winter seasons is 5% to 6% higher in the treatment group.

In all seasons, treatment farmers are more likely to operate an agricultural business, but overall numbers reporting this category remain rather low (ranging from 4%-8% of observations in the treatment group vs. 1%-3% in the control group).

Overall income does not appear to display significant differences between control and treatment farmers, but income data tends to be rather noisy. Interestingly, treated farmers see themselves as the main decision-makers in their household regarding agricultural matters significantly more than control farmers.

**Agriculture**. Tables 5, 6 and 7 report comparisons of indicators of agricultural practices and investments. Beginning with expenditures on inputs during the last year1 (Table 5), we find an evidence that treated farmers spent significantly more on hired labor, irrigation, renting machinery, seeds and seedlings and transportation of crops to the market than control farmers. The total amount spent by treated farmers was nearly double the amount spent by control farmers.

In Table 6, we compare farmers' perceptions of themselves in the household and as farmers. We find that most applicants do not possess the main decision making power in the household in either financial or farming related matters, but treated farmers are more likely to feel they have decision power over farming related matters. They are also more likely to perceive themselves to be better farmers than than the average farmer in the community (16% vs. 9%), and more likely to report having received formal agricultural training (71% vs. 17%), which is off course consistent with participation in the program, but also indicates the absence of formal extension alternatives within Nepal.

[1] This data is only available for waves 1 and 2.

Table 4: Employment

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| **Current employment - Dry season** | | | | | |
| Cultivation | 0.32 | 0.35 | -0.04 | 0.03 | 0.25 |
| Studying | 0.07 | 0.05 | 0.02 | 0.02 | 0.17 |
| Formal private sector | 0.26 | 0.21 | 0.05 | 0.03 | 0.05 |
| Own business - agriculture | 0.03 | 0.08 | -0.05 | 0.01 | 0.00 |
| Own business - non-agriculture | 0.06 | 0.07 | -0.01 | 0.02 | 0.72 |
| Other | 0.08 | 0.04 | 0.04 | 0.01 | 0.01 |
| Seasonally total income | 63480.01 | 62391.83 | 1088.19 | 5085.44 | 0.83 |
| Resided in home-village | 0.66 | 0.72 | -0.06 | 0.03 | 0.06 |
| **Current employment - Rainy season** | | | | | |
| Cultivation | 0.58 | 0.65 | -0.07 | 0.03 | 0.02 |
| Studying | 0.06 | 0.06 | 0.00 | 0.02 | 0.76 |
| Private sector | 0.16 | 0.13 | 0.04 | 0.02 | 0.12 |
| Own business - agriculture | 0.01 | 0.04 | -0.03 | 0.01 | 0.02 |
| Own business - non-agriculture | 0.04 | 0.04 | -0.00 | 0.01 | 0.97 |
| Other | 0.07 | 0.04 | 0.04 | 0.01 | 0.01 |
| Seasonally total income | 83518.20 | 81696.23 | 1821.97 | 6451.49 | 0.78 |
| Resided in home-village | 0.69 | 0.73 | -0.04 | 0.03 | 0.13 |
| **Current employment - Winter season** | | | | | |
| Cultivation | 0.54 | 0.62 | -0.08 | 0.03 | 0.02 |
| Studying | 0.07 | 0.05 | 0.02 | 0.02 | 0.26 |
| Private sector | 0.17 | 0.14 | 0.04 | 0.02 | 0.12 |
| Own business - agriculture | 0.02 | 0.05 | -0.03 | 0.01 | 0.01 |
| Own business - non-agriculture | 0.04 | 0.04 | -0.00 | 0.01 | 0.85 |
| Other | 0.08 | 0.04 | 0.04 | 0.02 | 0.02 |
| Seasonally total income | 67494.55 | 65030.64 | 2463.91 | 5547.70 | 0.66 |
| Resided in home-village | 0.67 | 0.72 | -0.05 | 0.03 | 0.10 |
| Total current annual income | 267851.99 | 273874.48 | -6022.49 | 17292.47 | 0.73 |
| Observations | 959 | | | | |

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Table 5: Agricultural Expenditures (past year, in Rupees)

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| Hired labor | 7892.90 | 14163.32 | -6270.42 | 2068.80 | 0.00 |
| Irrigation | 1746.29 | 3084.69 | -1338.40 | 519.34 | 0.01 |
| Renting machinery | 6717.78 | 9574.36 | -2856.59 | 1230.41 | 0.02 |
| Renting animals | 702.42 | 1029.86 | -327.44 | 312.10 | 0.29 |
| Seeds and seedlings | 2352.86 | 3744.09 | -1391.23 | 402.60 | 0.00 |
| Transportation of crops to the market | 1538.63 | 6001.61 | -4462.98 | 2039.07 | 0.03 |
| Total expenditure | 21228.89 | 39569.05 | -18340.17 | 5182.76 | 0.00 |
| Observations | 707 | | | | |

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Table 6: Perceptions

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| Better farmer than peers | 0.09 | 0.16 | -0.07 | 0.02 | 0.00 |
| Received formal agricultural training | 0.17 | 0.71 | -0.54 | 0.03 | 0.00 |
| Main financial decision maker | 0.07 | 0.07 | -0.00 | 0.02 | 0.95 |
| Main agricultural decision maker | 0.06 | 0.09 | -0.03 | 0.02 | 0.06 |
| Observations | 959 | | | | |

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Table 7 presents comparisons of market sales and investments in the farm. We find some, but rather noisy indications that treated farmers are more likely to sell their livestock and vegetable products in markets.

In total, less than 20% of the sampled farmers report having made a substantial investment in their farms over the past three years. However, treated farmers are indeed much more likely to have done so (24% vs. 13%), and this holds through most categories of investment - irrigation, plants/trees, livestock, land preparation and inputs (fertilizers, pesticides, seeds). The total amount of investment of the treated farmers is about 80% higher compared to that of the control group.

Amongst farmers that did not make such investments, control farmers are more likely to report lack of training as their key barrier for investing in their farm (71% of farmers). This is off course consistent with expectations from the training program. Treatment farmers are more likely to report risk as their key barrier for investment (64% of farmers). Treated farmers are also significantly more insecure about their ability to get a loan than the control farmers. Other reasons are equally likely for both groups.

**Income**. Table 8 reports comparisons of households' income sources, in terms of both amounts and binary indicators of whether the household gains income in various categories. We found that treated households are more likely to receive income from selling horticulture and from self owned businesses (including agricultural businesses which are likely to be driving the result). Continuously, treatment group income from these businesses is significantly higher than the control group's - more than double from horticulture and nearly 90% more from own businesses. On the other hand, control households are more likely to gain income from formal private or public sector jobs (significant only at 14% level) as well as from remittances, suggesting labor substitution options outside of agriculture.

Table 7: Agriculture - Earnings and investments (Rupees)

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| **Sale Amount (last year)** | | | | | |
| Cereals, pulses and legumes | 57328.24 | 63748.23 | -6419.99 | 5585.90 | 0.25 |
| Vegetables | 19693.36 | 25829.05 | -6135.69 | 4158.28 | 0.14 |
| Fruits | 150.75 | 113.61 | 37.14 | 85.84 | 0.67 |
| Oilseeds | 4586.19 | 5209.86 | -623.66 | 1568.87 | 0.69 |
| Cash crops and spices | 7616.72 | 5495.03 | 2121.69 | 1844.94 | 0.25 |
| Livestock products | 17894.44 | 22896.92 | -5002.47 | 2825.93 | 0.08 |
| **Investments (last three years)** | | | | | |
| Made substantial investment (Y/N) | 0.13 | 0.24 | -0.11 | 0.03 | 0.00 |
| Size of investment | 29186.30 | 52380.95 | -23194.66 | 8128.99 | 0.00 |
| **Reasons for lack of investment** | | | | | |
| Loan was refused | 0.08 | 0.10 | -0.02 | 0.02 | 0.36 |
| Believe loan will be refused | 0.15 | 0.19 | -0.04 | 0.03 | 0.10 |
| Risk | 0.49 | 0.64 | -0.15 | 0.04 | 0.00 |
| Lack of training | 0.71 | 0.47 | 0.24 | 0.03 | 0.00 |
| Other | 0.21 | 0.19 | 0.02 | 0.03 | 0.60 |
| **Investment made in** | | | | | |
| Irrigation | 0.06 | 0.12 | -0.06 | 0.02 | 0.00 |
| Greenhouse | 0.00 | 0.01 | -0.01 | 0.01 | 0.01 |
| Plants/Trees | 0.03 | 0.07 | -0.03 | 0.01 | 0.02 |
| Livestock | 0.05 | 0.12 | -0.07 | 0.02 | 0.00 |
| Machinery | 0.04 | 0.05 | -0.01 | 0.01 | 0.51 |
| Land preparation | 0.04 | 0.07 | -0.03 | 0.01 | 0.02 |
| Bore well | 0.00 | 0.01 | -0.01 | 0.00 | 0.20 |
| Land purchase | 0.00 | 0.00 | -0.00 | 0.00 | 0.17 |
| Inputs (fertilizers, pesticides, seeds) | 0.06 | 0.10 | -0.04 | 0.02 | 0.03 |
| Net house | 0.00 | 0.00 | -0.00 | 0.00 | 0.33 |
| Tunnel | 0.01 | 0.00 | 0.01 | 0.01 | 0.09 |
| Other | 0.02 | 0.06 | -0.04 | 0.01 | 0.01 |
| Observations | 959 | | | | |

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## Table 8: Income sources and amounts

| | Control | Treatment | Difference | S.E. | P-value |
|---|---|---|---|---|---|
| **Any income from… (Yes/No)** | | | | | |
| Horticulture | 0.30 | 0.36 | -0.05 | 0.03 | 0.08 |
| Cereals | 0.57 | 0.61 | -0.04 | 0.03 | 0.19 |
| Livestock products | 0.40 | 0.42 | -0.03 | 0.03 | 0.44 |
| Formal jobs (Government, companies, NGOs) | 0.52 | 0.47 | 0.05 | 0.03 | 0.14 |
| Wage labor | 0.05 | 0.05 | -0.00 | 0.01 | 0.80 |
| Own business | 0.16 | 0.21 | -0.05 | 0.03 | 0.04 |
| Remittance | 0.33 | 0.28 | 0.05 | 0.03 | 0.08 |
| **Amount of annual income from… (In RS)** | | | | | |
| Horticulture | 17758.12 | 37200.02 | -19441.89 | 7990.48 | 0.02 |
| Cereals | 74734.65 | 77701.30 | -2966.65 | 8748.42 | 0.73 |
| Livestock products | 21904.79 | 29405.39 | -7500.59 | 5239.73 | 0.15 |
| Formal jobs (Government, companies, NGOs) | 151851.46 | 157139.13 | -5287.67 | 16090.00 | 0.74 |
| Wage labor | 5668.12 | 3566.81 | 2101.31 | 2311.17 | 0.36 |
| Own business | 42254.90 | 79449.24 | -37194.34 | 13727.36 | 0.01 |
| Remittances | 219779.25 | 173355.26 | 46423.99 | 24830.26 | 0.06 |
| Observations | 923 | | | | |

Each row reports comparisons of means of the variables mentioned on the left hand side between the control (did not win the lottery) and treatment (won the lottery) group (`intent to treat' estimates). Columns 1 and 2 report mean values in the control and treatment group, respectively. Column 3 reports the estimated difference, and columns 4 and 5 report its standard error and the p-value. The sample consists of 959 individuals.

**Conclusion**. The results reported here are preliminary, but they point to a marked effect of the program on agricultural practices and investment. However, investments in modern technologies such as drip or sprinkler irrigation, protected cultivation (net houses, greenhouses) or mechanisation of the kind graduates of the program were exposed to in Israel, and are rare in Nepal, remain very limited. One gets the impression that the experience may have impacted the graduates' attitude towards farming (i.e. to be more commercially oriented) more than in terms of adopting new technologies.