Innovation in Nutrition-Sensitive Agriculture in Nepal

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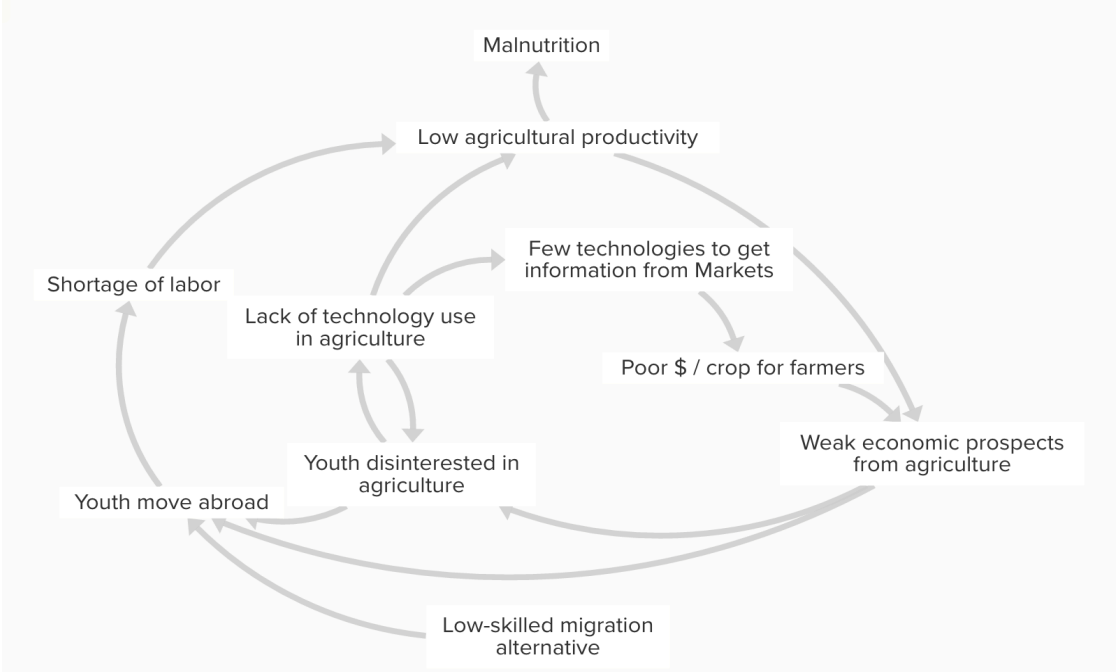
Introduction

The 2013 UNDP Progress Report on the Millennium Development Goals for Nepal highlights malnutrition as a major challenge. Nationwide, 41% of children aged 6-59 months were stunted; stunting, or low height-for-age, is an irreversible process caused by malnutrition during pregnancy and the first two years of a child's life. Rural areas, where people largely support themselves with subsistence agriculture, have higher rates of stunting (42%) than urban areas (27%). As a key recommendation, the report urges that Nepal must "*Invest in agriculture to increase food production and food security and reduce malnutrition. Encourage and support the modernization of agriculture to make this sector attractive to educated youth*." Similarly, the 2009 Nepal Nutrition Assessment and Gap Analysis recommends: "*provide technologies and inputs to increase productivity of staple food crops, particularly in marginal environments*."

Further analyzing low agricultural productivity from a systems perspective (see Figure 1.0), these studies suggest that youth disinterest in agriculture, the lack of technology in agriculture and a low-skilled migration alternative appear to be part of a vicious cycle of contributing factors.

Figure 1.0 Understanding Low Agricultural Productivity



In the 2014-2015 fiscal year, 527,814 young people left Nepal, which equals a rate of more than 1400 people a day[i].

This analysis led us to develop the following high-level design research questions:

- What are the interactions between agriculture and labor migration (in particular, to what extent are returning young migrant workers interested in pursuing agriculture?)?
- How might we get more of these young people interested in rural agriculture and nutrition?
- How might the adoption of technology play a role in this process?

For this project, we employed design thinking methodology, which encourages an iterative approach: an initial set of questions and assumptions are tested via research, which enables formulation of a more refined set of questions and assumptions that can again be tested, and so on. Following this methodology, over time, we included the following high-level research questions:

- What is the difference between commercial and *traditional* agriculture in Nepal? How do farmers view this difference?
- How do farmers learn new information and techniques? Are there gaps in existing educational resources?
- How might we encourage returnees from migrant labor to get involved in nutritionally sensitive agriculture?

Research Methods

This research was conducted in two phases during Summer 2016. Phase 1 employed qualitative, semi-structured interviews (see Appendix 2 for the interview protocol). Interviews aimed to surface farmers' perceptions and farmers' implicit attitudes through stories about themselves and/or others in their communities.

Phase 2 entailed preliminary pilot testing of a potential outreach strategy that emerged from Phase 1 data analysis.

Phase 1

We interviewed 8 individuals in Kathmandu with a broader perspective on agricultural innovation and engagement, in order to learn about the landscape of

agricultural extension and entrepreneurship. These interviewees included agricultural entrepreneurship consultants, farmer trainers, retired farmers, a maker of an agriculture-focused smartphone app, a retired journalist who is now a part-time farmer, and an organic farmer who sells directly to organic farmer's markets in Kathmandu.

We also conducted interviews with 18 farmers in Ramechhap district; the district capital is approximately 4-5 hours away from Kathmandu by bus. Ramechhap was selected as a location with mid-level agricultural development, in comparison with a set of 8-10 districts (including Chitwan, Kavre, Ilam, and so on) where the agricultural sector is seen to be highly developed, and another set of districts (primarily in the far western region) which experience food security challenges. Ramechhap was also selected in order to reach a sample of "positive deviants:" some young people working with farming using innovative methods. Two organizations, Daayitwa (based in Kathmandu) and YSP-Nepal (based in Ramechhap) assisted the research team to identify a wide variety of rural farmers and serve as local guides.

Due to monsoon travel restrictions, interviews were conducted in Manthali Bazaar (the capital of Ramechhap), Khimti (~1hr bus drive), Ambaas (~1hr bus drive and 15 min walk), and Chisapani (~3hr walk). Interviews were conducted in Nepali by Prabhas Pokharel and research assistants Dikshya Dhungana and Megha Shrestha (Kathmandu Living Labs).

Interviews were transcribed in Nepali and assessed for key emerging themes with respect to study questions.

Phase 2

Phase 2 of the study entailed prototype creation of a video-based approach to outreach/education and testing in response to Phase 1 findings and in order to further refine our insights. We created a simple video-based prototype about exposing new commercial farmers to new technologies and tools. After selecting mulching as the testing ground, we created a video prototype using the Stanford Design School's story-casting technique. After some initial testing with staff of Kathmandu Living Labs to test understanding and recall of information from the video, we created a second version of this prototype. We tested the second video with staff members at Kathmandu Living Labs, but also with two farmers in Kathmandu valley (one retired, one active farmer). We were unable to test in Ramechhap due to time constraints.

All references to the video prototype from now on will refer to the second iteration of the video. This video (Figure 2) employed the case of F. Subedi, who had produced a strong crop of bell peppers using plastic mulching. We used his case story to showcase how to use the "new" technology of plastic mulching for vegetable farming.[ii]

Figure 2. Frame-by-frame view of 2nd iteration of the video prototype.

Findings

Phase 1 activity provided an emerging set of insights about returning migrant workers' interest in agriculture, approaches to learning, and gaps in learning opportunities. Phase 2 provided emerging insights about the potential of video as a mechanism to support returning worker engagement in nutritionally sensitive agriculture.

Phase 1 Findings

Perceptions of Agriculture

In the context of Nepal's growing cash economy, opportunities to migrate for employment, and the hard labor associated with farming in much of the country, interviewees reported that agriculture is perceived to be a very low-preference profession. Most of the migrant returnees we met who were involved in agriculture as their profession didn't choose it originally: they were heavily encouraged by someone else**.** We heard stories of social ostracization for choosing agriculture as a way of life. For example, one farmer described having been ridiculed by his society, another noted his wife left him, and a third indicated that his wife doesn't support him because he is working on someone else's land.

Many of these are perceptions are rooted in experiences of traditional agriculture, which is centered heavily on rice and maize (or millet and maize) production; vegetable production (in Ramechhap) typically entailed scattering some seeds in maize fields, and agricultural activity did not generate revenue (and at best did not result in a loss). Interviewees reported that this translates into a broad general mindset: "traditional agriculture is 'old,' it is what our forefathers did because they had no other option." We heard that a popular saying used to get people to study is "If you don't study, you will have to plow the fields." Plowing the fields (with bullocks) is seen as one of the worst things you might have to do. Interviewees reported that for the general population working outside commercial agriculture, this tends to be a dominant attitude toward *all* agriculture.

Individuals who perceive themselves to be involved in commercial agriculture view it as quite different from traditional agriculture. They indicate that commercial agriculture includes the use of new techniques for farming as well as new technologies, new seed varieties and new animal breeds. Commercial agriculture can happen at quite a small scale in Nepal. We observed farms that ranged from 2-4 ropanis (1/4 – 1/2 acres) to 65 ropanis (8 acres) in Ramechhap. Vegetable growing was the most common form of commercial agriculture we observed. There were also dairy farms (with anywhere from one to five cows), as well as nurseries and orange farms.

Those with success through commercial agriculture see it as a respectable profession. Given the cultural status of involvement in agriculture, those who

manage to have success in commercial agriculture are eager to show others and take pride in their perseverance and success. Individuals meeting with some success appear to be increasingly highlighted in public media. This might be increasing interest in commercial agriculture, although it also might be generating some unintended consequences which will be described later.

Returning to Agriculture

All six migrant returnees interviewed report having returned to Nepal with a transformed work ethic that supported their transition into agriculture. One individual explained,

> *I worked 20 hours in 56 degree heat in the Middle East. Here at home, sure I clean up cow poop, but I only have to work max 4 hours a day. I'm practically living without working at all.*

Each of these returnees who are now in agriculture have a highly positive view of it. They described valuing working "their own" land, and working as their own bosses rather than working under for someone who does not even care about them.

However, most migrant returnees did not consider commercial agriculture as their first option for employment or investment when they came back. They often tried other professions, and entered agriculture with the support of their family members or their friends, often with a surprisingly lucky entrance.

Migrant interviewees noted that when abroad, most migrant workers are hungry for information from back home explaining, "we check all the sites, and Facebook all the time, and are always trying to find out what is going back home." Their online presence and networks of communication present potential mechanisms for sharing information about nutrition-sensitive agriculture as an economic opportunity upon their return or for families they have left behind.

Agricultural Learning

The word for technology in Nepali (प्रविधि) also means technique. Commercial farmers are quite interested in new techniques and technologies for agriculture, particularly as it distinguishes them from "traditional" agriculture. On farmers' Facebook groups such as Smart कृषि [iii], there is a large amount of curiosity (and post volume) around farming techniques used abroad. On the other hand, we also often heard, in response to mentioning technology from abroad a statement

very much like: “but that wouldn’t work here,” followed by an explanation of Nepal’s unique geography.

Similarly to other studies of farmer learning, farmers reported valuing the most direct experiential knowledge generated by trying and seeing something in their own fields. Most farmers are regularly engaged in trial and error.

They reported as second best seeing a practice on another person’s farm. Many of the farmers and entrepreneurs we talked to were inspired to start commercial farming because they had seen a successful example before. Farmers interviewed indicate that they are generally willing to share information, but in reality this sharing does not happen very often.

Interviewees identified traditional “trainings” as much less useful. For example, one person noted, “I went to a 5-day training. Then on the sixth day, we visited a mushroom farm. I’ve been doing what I saw in that mushroom farm that last day.” Only one farmer mentioned reading/books as a useful information source.

New technique adoption is bolstered by seeing examples of success. However, there are few avenues to share the results of Nepali farmers’ and other Nepal-based researchers’ trial and error. This can result in quite different perspectives and practices even in relatively close proximity. For example, hand tractors, which are just being adopted in Ramechhap, are seen as impractical for wet plowing; however, in neighboring Kavre wet plowing using hand tractors is a widespread practice.

An emerging emphasis in online news media on commercial agriculture economic success stories appears to be both increasing interest in agriculture and fostering unrealistic expectations. These stories tend to focus on the large farms with large amounts of investments. However, they present revenue generated, without a realistic sense of the specific context, associated activity and networks, and required investment. For example, an article with headline “10 million from mushroom farming[iv]” showcased a large amount of income but neglected to mention the associated level of investment. In two instances agri-business incubators shared similar versions of the following story.

A couple of guys came to us with some calculations about pig farming. They had calculated that they could earn a great amount of money in a few years. But they didn't know anything about pig farming. So we sent them to our demonstration farm for a week-long internship. They came back the second day, saying that they didn't know that pigs smell really bad and they couldn't really stand the stench."

These consultants thought this reflected an emerging reality of newcomers to agriculture hearing about big fortunes that can be earned in commercial agriculture, but knowing nothing about what it takes. They suggested that this phenomenon is leading to another one in which people take out loans to invest heavily in big commercial agriculture farms. Learning to farm, especially commercially, requires trial and error both in terms of farming and creating the right market linkages. While the real success stories have often started at small scale and grown slowly, given large investments some of these newcomers end up experimenting at scale, and have no cushion if they face losses in the first few years.

Nutritionally-Sensitive Agriculture

Agriculture—both commercial and home-based—has an important role to play in fostering healthy nutrition. According to the research presentation of *Home food production buffers against a diet of impoverishment in Nepal*[v], foods consumed regularly in one Feed the Future district in Nepal include rice, potatoes, legumes and vegetable oil. Animal products were infrequently consumed (median intake frequency: 1 meal per week), as were fruits and vegetables, most with a median weekly intake of frequency 0. In addition, researchers found that households that produce dairy, vegetables, eggs, and chicken are significantly more likely to consume these items, and recommend the increase of homestead food production.

Farmers interviewed were thinking about the use of pesticides as a link between their agricultural practices and health. They noted the effects of overuse of pesticides that they had seen on TV: cases of skin diseases and cancer that extreme usage of pesticides has caused. As a result, many of the smaller farms were trying to move away from pesticides. Some of the larger farms talked about making sure not to pick vegetables until the waiting period regulated by the pesticides. However, they had not considered the relationship between agriculture and nutritional well-being.

These findings together suggest that while traditional agriculture is seen as a very low-preference profession, commercial agriculture—even at a very small

scale-- that employs "new" techniques and technologies is much more likely to be seen as viable career option. Returning young adult migrant workers, or family-members left behind, often have a strong work ethic and some capital, making them an important constituency for cultivating nutritionally sensitive agriculture in Nepal.

To guard against the false promises of sensationalized reporting, support meaningful learning and encourage more rapid adoption and adaptation of promising practices, current and potential farmers appear likely to benefit from new types of educational opportunities. In particular, key elements may include:

- tapping both Nepali farmers' knowledge and broader agricultural research-based expertise;
- providing opportunities to "see" concrete farm-based examples, hear about them as a story narrative that incorporates important ecological, nutritional, social and economic contextual information, and ask questions;
- offering realistic, successful (and unsuccessful) examples of commercial agriculture launch processes, including business planning, financing, growing, marketing, etc.;
- showcasing the stories of successful farmers to give them pride and further motivation
- building on video and online technologies; and
- engaging young people from key target geographic areas/ethnic groups in producing and disseminating these resources.

Phase 2 Findings

Our preliminary testing suggests that the combination of case/story and how-to video was particularly effective in demonstrating a new technique.

In impressionistic tests, viewers from outside of farming demonstrated good understanding and recall of the mulching process after the video, including references to specific techniques for laying down the plastic that they had been introduced to (such as tightening the plastic around soil beds). Much of the open-ended feedback was about the need to increase the production quality, which is something we were aware of[1]. When asked about content, initial testers outside

[1] The video had been produced in the span of a day so that we could spend more of our time collecting feedback about its content.

farming demonstrated very little confusion, and good understanding and recall of material.

A small-scale commercial farmer in Kathmandu who that saw the video noted that the seeing a real farmer's experience made him think that the information was more trustworthy, and recommended including a phone number: he would want to talk to the farmer if he actually wanted to adopt mulching himself. When asked what questions he had, he wondered about where to find the right kind of mulching plastic. This suggested to the researchers that the breakdown of steps needed to actually use mulching was in the right direction, and that further breakdown should include where to buy the plastic. Critical comments were centered on minor language errors and video quality.

Another small-scale (retired) farmer who saw the video commented positively on the case-based nature of the video, and noted being inspired by the fact that the farmer hadn't given up despite his initial failing. Critical comments, again, were centered on language errors and video quality, with a suggestion to use live footage from farmer's fields.

Further prototypes should incorporate the following recommendations:

- use real imagery from Nepali farms, including some video in the how-to screens (suggestion from small-scale farmer);
- use the farmer's own voice for narration of technique (suggestion provided by the farmer whose case was presented);
- include review by and information from agricultural experts to promote inclusion of new/additional information that might not yet be available to the farmer and/or that might be relevant to adapting the technique in other parts of the country (researcher suggestion).

Design Principles for Video Making

In this section, in lieu of a providing a "template" for making videos, we will provide a set of "design principles" that underlie the prototype video. We recommend that material in the future, whether they take the form of video or other formats, follow these design principles for optimal success. For video production, these design principles could be considered a "template" for future production. Principles are separated into three sections: Content and Audience, Storytelling, and How-To Breakdown.

Design Principles for choosing Content and Audience

1. In picking new techniques and technologies to cover, pick existing working innovations, and advertise these to farmers who have not yet adopted these innovations.
   We observed that adoption of innovations is highly varied across different places in Nepal. As such, we recommend finding innovations that are already successfully adopted in areas with longer histories and higher prevalence of commercial farming, and spreading these to newer commercial farmers.

2. Leverage the need for recognition among commercial farming adopters.
   Because of stigma from traditional agriculture that applies to farming at large, the choice of commercial farming can often be a socially alienating choice. Recognizing success can be a key way of validating these choices for farmers who have seen some success.

Storytelling Principles

1. Use stories of real farmer experiences using those techniques and technologies, going so far as to include a phone number so that viewers can contact the original farmer.
   The reasoning here is that this is how we saw farmers learning in our interviews—they learned from other farmers' experiences.

2. Use visual storytelling techniques, because seeing is learning.
   In stories that we heard about learning from others, seeing *other farmers' farms and experiences seemed to be very important. Video or other visual media should be used to more scalably approximate a field visit.*

3. Show stories of agricultural success, framing the farmer as the protagonist and the technology as a "sidekick" in a hero story.
   A popular storytelling technique is the hero's journey[vi]. Using a short form version[vii] of the hero's journey can be a powerful narrative, in this case portraying the farmer as a hero aided by technology-as-sidekick to achieve agricultural success.

4. When possible, show strategies for overcoming hurdles that the farmer encountered in adopting the new technology or technique.
   The reasoning here is these that hurdles aid to the hero's journey narrative, as well as the fact that new technology adoption is often associated with high rates of

initial failure. Because commercial farming can have high cultural cost of success, providing strategies for overcoming hurdles is very important.

How-to Principles

1. Break down the steps of technology adoption into a sequence of behaviors.
   This is a well-known technique in behavior design. By breaking down the behavior, you increase the ease of doing the behavior, one of the most effective ways to increase behavior change.[viii]

2. Use three to five steps when breaking down the steps to technology adoption.
   This is because of two universal design principles related to memory. The "Depth of Processing" principle is a phenomenon of memory in which information that is analyzed deeply is better recalled than information that is analyzed superficially. Second, "Chunking" is a principle related to short-term memory, which notes that the maximum number of pieces of information (chunks) that can be efficiently processed by short-term memory is four, plus or minus one[ix].

3. When presenting the reasons to adopt technology, present advantages as well as challenges presented by the technology.
   As discussed, there is plenty of hyperbole reflected in success-based reporting of commercial agriculture, some of which is encouraging careless entry into commercial agriculture. Challenges presented by new technology need to be presented so that farmers see a more realistic picture of new technology adoption. They are also likely to trust this highly experiential information more.

Discussion and Conclusions

We begun this paper with the need identified by the UN Millennium Development Goals review, which recommended the need for modernizing agriculture in order to solve Nepal's considerable nutrition challenges. We also identified the huge amount of migration that takes place out of Nepal every year. Based on field research, we see a large opportunity to get young migrant returnees interested in commercial agriculture, using the involvement of modern technologies and tools as both an incentive (*traditional* agriculture has stigma, which can be overcome in commercial agriculture), as well as a way to create higher productivity in agriculture.

After studying agricultural entrepreneurs in Ramechhap, we find that commercial agriculture is an emerging profession in Nepal where people are *looking* for new techniques and technologies. However, the high rate of initial failure during adoption as well as stigma attached to engagement in agriculture have conspired to minimize information sharing about the nitty-gritty details of how these technologies and techniques are best used in practice. Moreover, we find that farmers are very experiential learners, trusting their own experience followed by the experience of other farmers. This is very reasonable, given that outsiders can easily mistake features of new technologies and techniques that seem useful at the outset, but may or may not be relevant to the actual experience of farming.

In response to these findings, we developed a video-based learning prototype that combines storytelling from real farmer experiences and behavioral design principles of breaking down complex behavior. We share a prototype that was made for mulching and was successful based on initial tests, and provide a set of design principles, which can be considered as a template for future video production. We encourage further exploration of approaches that link agriculture and health/nutrition extension efforts, ICT use and youth engagement to facilitate social change, knowledge development and geographically and culturally appropriate tailoring of agricultural and nutrition information.

Appendix 1: Interviewee Profiles

8 Birds-eye Stakeholders(Kathmandu)

1. Retired farmer from Jhapa.
2. Retired schoolteacher and tea farmer from Ilam.
3. Founder of an agriculture-focused app and Facebook group.
4. Two agriculture consultants and agricultural outreach magazine publishers
5. Retired journalist, farmer and food innovator.
6. Organic Farmer and Farmers Market Seller (a couple)

***Birds-eye Interviewee Demographics*:**

6 Males, 2 Female. 7 Brahmin / Chhetri, 1 Newar

19 Farmers (Ramechhap District)

1. Dairy entrepreneur.
2. Nursery farmer.
3. Vegetable farmer (both wife and husband interviewed; wife owned farm).
4. Fish farmer, returnee from the Middle East.
5. Vegetable and mushroom farmer (both wife and husband interviewed; husband owned farm).
6. Grass farmer.
7. Vegetable farmer.
8. Chicken farmer, returnee from India.
9. Vegetable famer, returnee from Malaysia.
10. Vegetable farmer.
11. Paper factory entrepreneur.
12. Tomato growers, male returnee from Malaysia (wife/ husband interviewed)
13. Vegetable and rice farmer.
14. Cow farmer, returnee from Saudi Arabia.
15. Cow farmer, returnee from Dubai.
16. Orange farmer and squash factory owner.
17. Bell pepper and vegetable farmer (from Makwanpur District).

***Farmer Interviewee Demographics*:**

17 Males, 3 Females

8 Brahmin / Kshetri, 9 Newar, 1 Majhi, 1 Magar, 1 Lama

7 returnees from labor migration (Middle East, Malaysia), 6 returnees from internal migration (Kathmandu, Biratnagar), 5 Ramechhap natives who didn't migrate, 1 migrated to Ramechhap via marriage, 1 interviewee from outside of Ramechhap.

Appendix 2: Farmer Interview Questions

We are researchers who are trying to understand agriculture in Nepal, and in particular the differences between commercial and traditional agriculture. We came to know of you because of your participation in the Daayitwa Enterpreneurship challenge, and are hoping that you could answer a few questions for us.

Rapport / Who the person is

Objective: Who is this farmer and how do they fit into our picture of various farmers? Establish that we want a lot of details and stories in their answers to our questions by responding positively (via body language, facial expressions) to details and stories, and asking for details and stories when they give short answers or provide generalizations.

Questions:

- Where are you from? Where is your family *originally* from?
- Tell me a little bit about this village / town / place. What do you find to be special about this place?
- Tell us about your day-to-day schedule here. When do you wake up? What do you do next, etc?
- Did you go to school? How much? How long have you been farming?
- Tell me how farming has changed, if at all, from when you were a child?
- Tell me about your day. Let's pick yesterday. What time did you wake up? What next? What next?

Migration

Objective: Understand their migration story.

Questions:

- We understand that you migrated abroad. Can you tell us about that?
- When did you migrate? How long did you stay?
- Tell us about your life right before you migrated. What was your situation like? How did you make the decision to migrate?
- Tell us about your life abroad. What was your day-to-day schedule? When did you wake up? What next? What next?
- Tell us about when you first thought about coming back. What happened next? What was your decision-making process like?
- Are there others like you who want to come back? Who are the ones who come? Who are the ones who stay?

Arrival and Information Gathering

Objective: Understand what happened when they returned. What were their support networks like? Were their social networks disrupted? Did they lean on family, friends, other returnees, outside institutions, local NGOs?

Questions:

- Tell us what happened after you arrived. Tell us about those days. Where did you go? Who did you talk to?
- How much $$ were you able to save up for coming back? Where did you save it? How did you bring it back?
- When did you start thinking about going into X (agriculture / business)? How did you make your decision?
- What was your process for finding out how to proceed? Did you find it easy or hard to find information about what to do? Do you think it is any different for you than someone who didn't migrate?

Decision-Making

Objective: How do people make investment decisions? How do they think about accounting? Short-term vs. Long-term accounting? What influences these decisions (eg. loans)?

Questions:

- What options did you consider based on settling on doing X?
- What were your main criteria?
- How did you think about the economic prospects of X? [probe on Investment vs. Returns vs. Time in between.]
- What non-financial considerations did you make? What did your family think?
- Did you think about potential failure cases? How did that influence your decision-making?

Markets

Objective: How do people think about markets? How much do they know about what happens after goods leave their farms? What is necessary between harvest and sales?

Questions:

- What does the market for X look like?
- Who do you sell to, for how much? How do they pay you?
- Who ultimately consumes the product? How much do they pay?
- Are you happy with the set-up you have?

- When do you usually sell your product? Tell us about what happens between harvest and the time your product leaves your land. (Spend some good time on this question.)
- What happens after that?

Nutrition

Objective: How does nutrition influence decision-making, at day-to-day levels as well as investment decisions?

Questions:

- How much are you growing for selling? How much for eating?
- How do you think about your and your family's nutrition?
- How does nutrition influence your day-to-day life and life in your community?
- How, if at all, did you think about nutrition when you were starting your X agri-business?
- The agriculture sector can play an important role in making sure that our people have enough healthy food to eat. Would you be willing to consider nutrition information in your planning? If so, what kinds of information might be helpful? How might you want to receive that information?

Reflection

Objective: Hear generalized reflections about our topic of interest.

Questions:

- How do you think migrant returnees are different than your average person?
- What advice would you give to someone considering returning?
- What advice would you give to someone who returned but doesn't know what to do next?

Appendix 3: Interview Summaries

Farmers (Ramechhap District)

1. Dairy entrepreneur.

Lived in Kathmandu as a pharmacist. Was interested in moving back to Ramechhap, considered many businesses, chose dairy. Learned how to run a dairy by observing the main dairy facility in Kathmandu. Strong sense of social purpose for moving back to Ramechhap. Started the first dairy business in Manthali. Now there is a copycat. Created incentives for 19+ registered cow farms (~90 hybrid cows) in the surrounding areas, processes 900+ liters of milk in the summer months. Has re-defined "cold drink" to mean dairy product in the local market. (Elsewhere in Nepal, that term refers to soda).

2. Nursery farmer.

From the hills of Ramechhap, also a leader in the local Maoist party. Has tried many forms of agriculture, including tea farming, alaichi, and now working on a nursery. Farming on rented land; wife has many issues with his choice of profession. Neither son supports him in his choice, which he feels badly about this. Highly innovative with farmer's practices, has a green thumb, experimenting with fermented organic pesticides.

3. Vegetable farmer (both wife and husband interviewed; wife owned farm).

Wife owns the farm; both husband and wife are actively bought into the farm. Mostly vegetable farmers, also own 5 hybrid cows and sells milk to the dairy entrepreneur (#1). Husband moved to Biratnagar and worked running a stationery shop for many years. The neighbors farmed vegetables. He moved back to Ramechhap to start farming his native land. Not supported by his family to do so, but he enjoys it. Wife originally had resistance to farming, but since the farm is registered in her name, and she is being recognized as a successful agriculture entrepreneur, they are leading the farm together now.

4. Fish farmer, returnee from the Middle East.

Worked in the Middle East as an electrician. Extremely long days, hard work. Moved back to start a automatic door installation business with a business partner in Kathmandu. They installed doors for the business partner's friends, some of whom never paid up, etc. On a visit back home, dug up a rice farm close to the house to make a pond. Originally because he thought of it as a status symbol. Put fish in to make the pond productive, and turned out it was a really good business. Originally, father opposed digging up the rice

fields to make a pond, but after fish started growing, he started tending the pond and is one of the champions of the fish business. They are from the Maajhi (fishermen) caste. Took some training on fish raising in Janakpur, where he got the hatchlings. Moved back after the fishpond became a good business. Now a community leader, and has started other agriculture initiatives, including raising hybrid pigs (bangur).

5. Vegetable and mushroom farmer (both wife and husband interviewed; husband owned farm).

Husband migrated to India for work, worked in various locations there. At one of this down moments, there was a guru who told him that farming would be a perfectly viable profession. He came back and started a vegetable farm, which his wife is going along with, but with reluctance. She considers commercial farming to be a lot of work. Husband went to a training for a week, and observed a mushroom farm at the end of the training, during a visit. He then replicated that mushroom farming setup himself.

6. Grass farmer.

Grass farmer in Chisapani, converted his traditional vegetable farms to farming grass because of labor availability issues. Grass farming does not require very much labor. Grass is overgrown, and transportation issues make it difficult for them to sell their grass in volume.

7. Vegetable farmer.

Vegetable farmer who is trying to graft pumpkin and cucumber plants after learning it at a training (unsuccessfully), as well as planting asparagus and a variety of sweet potato that is not usually grown in his neighborhood. Recently had his thumb cut off in a grass cutting incident, and was telling a a story about coming face to face with a tiger in his younger days when we started the interview. Talked about the importance of visiting farms and seeing other farmers in order to learn. Emphasized that ultimately, you have to try it youself in order to learn anything (which was evident in his experiments).

8. Chicken farmer, returnee from India.

Labor migrant to India, was making some money, but returned because his daughters had to get married. Chose chicken farming because farming broiler chickens is very straightforward and makes good money.

9. Vegetable famer, returnee from Malaysia.
Migrated to Malaysia, and worked in orchards there. Talked about missing home and checking their technology devices from any updates from home when abroad. They would check news sites, Facebook, and in general try to get any update from home that they could.Is from a well-known family in his village. When he moved back, he worked as an NGO worker, which was useful to get to know people in the community, all of whom he had lost connection with after migrating. Entered vegetable farming in partnership with friends, including someone involved in agriculture. Didn't work well at first because of lack of ownership. However, he calculated that it would make a good profit if well managed and took it over. Uses pesticides. If the pesticide says wait 3 or 4 days for picking, he will wait the requisite amount before picking. If the pesticide says to wait for 20 days before picking, he'll wait a week or so before picking the vegetables. Also tried chicken farming early on. In his early batches, he lost 75% of the chickens. Chickens were making good profit for a while, but there is too much competition at the moment, so no longer raising chickens. Transportation to the market is a challenge for this village; wants to create a conglomerate of farmers that pay a lower price for a hired jeep.

10. Vegetable farmer.
Very successful vegetable farmer, estimated to supply one-third of the local vegetable market. Uses tractors and roto-tillers, and is building metal truss-based tunnels for a small nursery. Farms 65 ropanis of land in the winter, and irrigates using submersible pumps embedded in the river that flows near his farm. Grew up in a neighboring district, and saw a model farm when he was a child. Always had an aspiration to replicate that, and create a farm where he used modern technology to have great produce. However, for a long time, he worked as a schoolteacher. When he decided to come back to farming, he had some family members cut ties with him due to the unpopularity of that choice. When he started, he had trouble renting land. Now he farms on 65 ropanis of land, and is well respected in the community. Has high regard for hard work; known to have said at a conference that "only people without hands and feet should be considered unemployed. Everyone else should be able to earn for themselves without a problem."

11. Paper factory entrepreneur.
Running a paper factory in his local Ramechhap after moving back from Kathmandu where he learned his management skills. His biggest issue is sourcing material for the paper production. Lokta, the majority of what is

used for paper production, is only found above 3000m and is currently found in the jungle rather than cultivated. As a result, he is involvemed in efforts to help cultivate Lokta, which due to elevation have to happen in a village 4 or 5 hours away.

12. Tomato grower, returnee from Malaysia.
Started farming hybrid tomatos after visiting and apprenticing in a tomato farm near Bhaktapur, where they were using new techniques imported from Israel. Originally managed a co-operative farm, but decided to venture out and start his own private farm. Currently having issues with pests on the tomato plants. He has tried a variety of organic methods of fighting the pests, none of which has worked. He has had to uproot three batches of tomato plants and burn them. His wife, who is a partner on the farm, notes that the experience of uprooting their tomato plants and having to restart repeatedly is causing her to question their decision to commercially farm tomatoes in the first place. The income is good when they grow, but pests are a big problem.

13. Vegetable and rice farmer.
[Unplanned visit; was not an introduction through our NGO partners.] We interviewed him because we observed a roto-tiller in action, and we started asking a couple of questions. He noted that he had moved to Kathmandu to study Hotel Management, but recently moved back and begun to manage the family farm. He calls his entry intro agriculture "accidental," after a few friends encouraged him to participate in local trainings and register his farm. Since then, he is trying to introduce some innovations into the farm, like a roto-tiller, which is a first in the village. Until last year, they used to rent a roto-tiller from the neighboring village for a specific point in the farming season, but he decided to invest in a tiller himself because of a government subsidy. It is also useful for vegetable farming, which he is also getting into now, partially as a result of government subsidy as well.

14. Cow farmer, returnee from Saudi Arabia.
Drove a truck in Saudi Arabia, for 20 out of 24 hours. He would sleep four hours in the middle of the day to avoid the heat. When he came back to Nepal after that grueling work, he first tried driving, even working at a bank, but eventually settled on cow rearing after his father invested in two hybrid cows. They have a refrigeration system, and he also transports neighbors' milk for a small fee into town, which is about a half an hour drive away. He goes there with milk in a motorcycle. He says that the "hard work" of cow rearing is nothing to him after the kind of work he did in Saudi Arabia. Even

though he has to collect cow manure, he thinks of himself as essentially doing nothing since he only has to work for four hours during the day.
Discovered that the breed of cow they are raising *will* eat cornhusk, despite popular belief, if it is chopped up fine. In order to do so, they have converted a manual feed-cutting machine to automatic with the help of a local electrician.

15. Cow farmer, returnee from Dubai.
Relative of cow farmer (#14); began raising cows after seeing his cousin's success. Eager to show us around, seeing that people from out of town were interviewing and hearing about his cousin's experiences. Has also adopted the feed cutting innovations that his cousin introduced. Having trouble taking care of his cows because of a father with ill health.

16. Orange farmer and orange squash factory owner.
[Encountered in a teashop.] Talked about the development of the orange squash factory as a key innovation that has rekindled interest in orange production. Oranges grow well in Ramechhap village. At one point, it was grown in small quantities. When air transportation to Kathmandu started, farmers started growing oranges in orchards and had a great period of profits. When the road opened up, however, entrepreneurs from Kathmandu came in and bought orchards at a time from farmers, at much lower costs than the oranges were sold in in Kathmandu. This demoralized farmers with orange orchards, until the orange squash processing plant opened up in Ramechhap as a farmers' co-operative, and farmers started getting better value for their oranges again. He emphasized the importance of post-production entrepreneurship in agriculture (another example of this is the dairy enterprise; see interviewee #1).

17. Bell pepper and vegetable farmer (from Makwanpur District).
This farmer was from a different area than where the study was conducted. We approached him because he was active on Facebook, where he had been posting about mulching, which he had recently adopted, as well as a great crop of bell peppers, of which he had taken great photographs. Mulching was a technology that was being used widely in Kathmandu, but hadn't been adopted in Ramechhap at all, so we decided to talk to him about his experience, and make a video about his experience. When talking to him, we realized that out of three initial attempts at mulching, he only succeeded once, which highlighted the high initial rates of failure with new technologies in agriculture. His posts on Facebook also provided insights, including the

fact that responses to a successful-looking bell pepper harvest on a Facebook post including elicited comments that suggested that other farmers wanted to talk to him and/or visit his farm to learn about his approach[x].

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[i] Shrestha, Ramesh. "Number of migrants leaving for foreign jobs on the decline" The Himalayan Times. July 19, 2015. http://thehimalayantimes.com/business/number-of-migrants-leaving-for-foreign-jobs-on-the-decline/

[ii] Note this effort does not constitute endorsement of the method but rather assessment of a video use strategy.

[iii] Smart कृषि Facebook Group. https://www.facebook.com/smartagroapp/

[iv] Nepal, Janak. "च्याउ खेतीबाट करोडपति" (Translation: 10 million from mushroom farming). http://kantipur.ekantipur.com/printedition/news/2016-07-14/20160714124852.html

[v] West, Keith P. "Home Food Production Buffers against a Diet of Impoverishment in Rural Nepal." http://dl.tufts.edu/bookreader/tufts:17324#page/1/mode/2up

[vi] Vogler, Christopher. "A Practical Guide to Joseph Campbell's The Hero with a Thousand Faces." *Hero's Journey* (1985). Available at http://www.thewritersjourney.com/hero's_journey.htm Accessed December 1st, 2016.

[vii] Vogler, Christopher. "Hero's Journey Short Form" (2011). Available at https://chrisvogler.wordpress.com/2011/02/24/heros-journey-short-form/ Accessed December 1st, 2016.

[viii] Fogg, Brian J. "A behavior model for persuasive design." In *Proceedings of the 4th international Conference on Persuasive Technology*, p. 40. ACM, 2009.

[ix] Lidwell, William, Kritina Holden, Jill Butler, and Kimberly Elam. 2010. *Universal principles of design: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design*. Beverly, Mass: Rockport Publishers.

[x] Facebook post on "Kisan (farmer)" Facebook Page. July 11, 2016. https://www.facebook.com/groups/1580835842170587/permalink/1710544425866394