

Canadian International Food Security Research Fund (CIFSRF) - Contribution Analysis

Country Report

Innovations for Terrace Farmers in Nepal and Testing of Private Sector Scaling Up Using Sustainable Agriculture Kits (SAKs) and Stall-Based Franchises (IDRC project #107791)

Nepal Terrace Farmers and SAKs

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That said, the arguments and opinions presented here, as well as any errors and omissions, are those of the authors alone and do not necessarily represent the views of LIBIRD, IDRC, ODI or NISER.

Abbreviations and glossary

CIFSRF	Canadian International Food Security Research Fund
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DADO	District Agricultural Development Office	NGO	Non-governmental organisation
DHS	Demographic and Health Survey	Rs	Rupees, in late 2017 Nepali Rs 100 = US\$103
FGD	Focus Group Discussion	rupani	Land area. 20 rupani make one hectare
GAC	Global Affairs Canada	SAK	Sustainable Agricultural Kit
IDRC	International Development Research Centre	tole	Small group of households, around 5 to 7, or hamlet
KII	Key Informant Interview	VDC	Village Development Committee. Before March 2017, this was the smallest administrative unit in Nepal
LIBIRD	Local Initiatives for Biodiversity, Research and Development		
NARC	Nepal Agricultural Research Council		

Overview

Nepal SAK		
Project activities, deliverables and results		
Theory of change	Agricultural innovations lead to higher production, more income, save labour	Using commercial networks to sell seeds and tools associated with innovations will lead to spread of innovations
Activity	Team highly engaged: active problem-solving, close and frequent contact with participants	With Anamolbiu, a seed company, team have done much to get seeds and tools to agricultural co-operatives, agro-vet dealers
Changes to capacity, behaviour	Most farmers have found at least one innovation from menu useful and have adopted it	Seeds and tools found to be in stock with co-ops and agro-vets; but a limited range on offer. [Often just the corn sheller and packs of veg and legume seeds] Some agro-vets promoted these items: others were more passive. Items stocked on sale or return
Results	Farmers report, depending on the innovation, increased output; or else labour saved	Sales of some items have been large; but only for some items, with the corn sheller by far the most prominent
Impact	Incomes increased, more diverse food in household diets, less drudgery	In some areas, seeds and tools available for innovators
Sustainability and scaling up		
Sustainability	High for simple innovations with clear benefits. Questions arise over innovations that have complex and not necessarily obvious effects	Still to be seen. Some agro-vets reported they were sending back stocks
Scaling up	Not clear how this will spread most innovations across the mid-hills of Nepal: commercial networks not broad enough. Commercial distribution has little impact on innovations that are matters of farm practice and not clearly embodied in a tool. Hopes vested in picture book, videos: probably requires large-scale engagement with public extension service	
Specific outcomes		
Food security	Many innovations lead to higher production of foods with high content of protein, vitamins and minerals. Very probably leading to more diverse household diets, even if some vegetables are sold.	
Income	Several innovations generate more income. Often quite small increments likely, but one technology — poly-tunnels with drip irrigation can generate substantial additions [+US\$100 a season]	
Sustainable agriculture	Increased farm output from intercropping, use of terrace walls and risers, better use of manure Several innovations promise to improve soil fertility and to protect terraces against soil erosion	
Gender	No explicit gender activity; but project works with women. They report the project helps them become more independent of men in farm labour; helps them generate small additional income under their own control.	
Unexpected findings	Extent of women's empowerment	
Research partnership and policy influence		
Research partnership	Highly active, productive collaboration between Guelph and LIBIRD, in some cases generating technical proposals that would have been unlikely without the partnership.	

Contribution to policy or wider results	Much interaction has taken place with the Ministry of Agriculture. Degree and extent of influence not assessed.
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Colour coding:

Unsatisfactory: very little achieved	Some gains, but achieved less than expected	Some progress: about half of what was expected	Largely successful: most objectives achieved	Highly successful: all objectives achieved, in some cases by more than expectations
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White: not assessed

Executive summary

This report forms part of a contribution analysis of the Canadian International Food Security Research Fund (CIFSRF). The Fund aims to test, develop and to begin scaling up innovative approaches to improving food security for the benefit of farmers, especially women farmers, and consumers on low incomes.

As part of a contribution analysis carried out by the Overseas Development Institute, six research projects funded under CIFSRF Phase Two were selected for more detailed study in the field. One of those is Nepal Terrace Farmers and Sustainable Agriculture Kits (SAK) — from here on referred to as SAK Nepal.

This study aimed to assess the emerging results and impacts of SAK Nepal and to derive lessons from the experience.

The project has been implemented by a Nepali NGO, Local Initiatives for Biodiversity, Research and Development (LIBIRD), in partnership with the University of Guelph in Canada.

SAK Nepal was designed to test agricultural innovations for farmers in the mid-hills of Nepal and disseminate those found successful. Land is scarce in the mid-hills, much of it steeply-sloping, so that increased output must come from intensification of farming. High rates of out-migration by men means that women who remain in the villages have to do much of the farming, in addition to domestic work. Hence innovations suited to terraces need to save labour, raise land productivity, or both.

To scale up useful innovations, the project planned to work with private sector companies, distributors and retailers to make seeds, tools and other equipment available to farmers.

SAK Nepal has thus seen two major sets of activities:

- development and testing of innovations for farming with farmers in Majhthana, Kaski District, and Jogimara, Dhading District;
- working with a seed company, Anamolbiu, private agro-veterinary dealers, agricultural co-operative and village snack shops to stock and promote sales of the seeds, tools and other equipment needed for some of the SAK innovations.

The evidence for this report comes largely from two sources: project records; and interviews with project staff, farmers in Majhthana and Jogimara, agro-veterinary dealers, and government staff carried out during a two-week field trip to the project sites by the two authors in late October 2017.

To review the project, theories of change were constructed for the two sets of activities, which formed the basis for questions to test project results from activities along the causal chains to impacts. Given that SAK Nepal had yet to conclude its work by October 2017, much of the assessment was on evidence of intermediate outcomes, rather than ultimate impacts.

Findings

LIBIRD with Guelph has energetically implemented the project, doing more than might be expected for the resources they had. It would be hard to find fault with what the project team have done. Indeed, they have worked hard to implement the project to the benefit of farmers, despite, as is inevitable with research programmes, coping with unforeseeable obstacles — including the 2015 earthquake.

More than one hundred technologies suitable for hill farmers were considered, some 46 were tested in the field and at least 20 of them have been effective and welcomed by farmers. The farmers met appreciated the project, had learned several new techniques, and had been able to select from the extensive menu some things to their advantage. They had tried these on their

farms and most had been effective. Innovations had led either to higher yield and more production of a more diverse range of crops; or to reduced labour time and less arduous or unpleasant work.

The innovations were well suited to the circumstances of most farmers, including women farmers. Many of the innovations were, produced in themselves, small but valuable changes at the margin: such as those seen through intercropping, better management of farmyard manure, and adopting a simple, hand-held tool to shell maize much faster than shelling by hand alone.

Some innovations involved greater changes. Small, 50 square metre, polythene houses with drip irrigation could produce 300 kg of tomatoes a season. So strong were the potential returns to off-season vegetables, that some young males saw this as a genuine alternative to migration out of the village. They reckoned that the income from the vegetables would be almost as good as their earnings from migration, net of travel costs.

Similarly, power tillers allowed women to grow crops independent of the need for oxen and buffaloes and a ploughman. Powered millet threshers potentially saved much time that women would spend on hand threshing.

In large measure, the theory of change for testing and adoption of agricultural innovations had been realised in practice.

On commercial distribution, the collaboration with Anamolbiu had generated an impressive effort to get seeds and tools out to the rural areas through co-operatives and agro-vets. Some elements of the kit had clearly been a commercial success: hand-held corn shellers above all, with reasonable success with some of the seed packets, and the grain bags. It seemed that much of the seeds, tools and equipment needed for technical improvements were available commercially within range of the project sites.

Sales, however, were for the time being modest for most items other than the corn shellers. The agro-vets were seemingly prepared to stock some of the items, but these were secondary to their main sales lines, such as the poultry feed, fertiliser, agro-chemicals and veterinary medicines.

The successful adoption of innovations promoted by SAK has led in in first instance to greater farm production, through intercropping, better fertilisation and use of terrace walls; as well as to savings in labour for some time-consuming tasks.

SAK Nepal's innovations in most cases promote farming that conserves soil and water, as well as working more

with ecological processes and local materials, rather than using manufactured fertilisers and chemicals.

Agricultural innovation has led to improved food security for project participants. Higher production of food on hill farms, especially of foods relatively rich in protein, vitamins and minerals has encouraged more consumption at home to more diverse diets.

Some farmers have seen higher cash incomes from sales of extra output. While in many cases, the gains are limited to US\$30 a season or less, that income can be particularly welcome when, as is often the case, the income accrues to women farmers. Poly-tunnels, however, can generate very high returns, with US\$200 earned over three years from a typical plastic greenhouse, net of costs of the house and equipment.

SAK Nepal works mainly with women farmers. Innovations have been promoted and tested with women farmers in mind: hence the focus on saving time and reducing drudgery. The impact on women farmers, however, has been wider. Women farmers appreciated the chance to farm without having to rely on men, to raise crops and increase their earnings. They felt empowered by these changes.

Research partnerships and policy influence

The partnership between the Canadian universities, led by Guelph, and the local partner LIBIRD flourished. Both parties have been imaginative, capable, resourceful and energetic. The result has been an ambitious project where much thought has been given to what to do, how, and to reacting to emerging outcomes. This explains in large part why so much has gone well.

IDRC, through its desk officers, has actively supported SAK Nepal. The degree of engagement of IDRC with the project was rated by the SAK team as exceptional. That engagement has gone well beyond active interest, to being a source of useful suggestions, additional funds, and help to revise project programming when the programme had to react to an import blockade by India, and the 2015 earthquake.

SAK Nepal is in many respects an exemplary rural development programme. That is almost entirely down to the calibre of the leadership of the partners, and the dedication and talent of the project staff in general. IDRC has made this possible, through its commissioning of such capable partners and by the support provided after the grant was awarded.

While SAK Nepal is a relatively small agricultural programme, especially when compared to those funded in Nepal by the major multilateral and bilateral development partners, it has been able to attract

national attention. LIBIRD has active contacts with policy-makers. Through its publications — more than 40 published, in draft or planned, most in the natural sciences — SAK Nepal has documented the science of the innovations.

Although SAK Nepal has cast a wide net in the search for appropriate innovations for the hill villages, neither livestock nor fruit have received as much attention as they might have, given their importance and potential on hill farms.

SAK Nepal may have a multi-disciplinary team, but a little more attention could be given to the economics of the innovations. Simple gross margin analysis could be very useful.

Sustainability and scaling up

Whether the innovations adopted will be sustained will probably vary by the improvements in question.

For those techniques that are technically simple, requiring skills that are readily learned, where the task does not greatly vary, and where the benefits can be clearly seen at the time of using the technique, innovations once adopted are almost certain to be sustained. Corn shellers and rakes are good examples.

Innovations that are more costly and complicated are also likely to be sustained, when they show high commercial promise. Plastic houses with drip irrigation are quite costly, and require skills to irrigate, fertilise and protect a crop of tomatoes. The returns are sufficiently great, however, for people to invest, learn the skills and tend the growing crops diligently.

Other innovations, such as intercropping, may be more demanding, with benefits less perceptible, and hence more vulnerable to being dropped.

SAK Nepal never intended that all farmers would adopt the gamut of innovations: it was always recognised that farmers would select from the menu according to their circumstances and preferences. As circumstances change through time, so may decisions to use one technology or another.

SAK has two different channels for scaling up. One is the commercial distribution of seeds, tools and equipment that was reviewed in this study. This has had some success. Some seeds and tools are indeed being stocked by agro-vets in rural market centres. Nevertheless, the extent to which this will allow dissemination across the mid-hills of Nepal may be limited, partly because the agro-vets tend to be in market centres, in well-connected zones and do not provide even coverage of

the mid-hills, and partly since not all innovations are embodied in a physical product.

SAK Nepal has other ways to reach farmers, through a field-tested picture book, and through short, YouTube videos. While it may well be possible to diffuse these materials across the hills, they probably need support from extension agents who can explain in more detail, answer queries, and stimulate interest.

It may be possible to do this in partnership with the public agricultural extension system, but it will take time and additional resources to do so.

1. Introduction

1.1 Purpose of report and aims of study

Introducing CIFSRR

The Canadian International Food Security Research Fund (CIFSRR) was designed to address global problems of food and nutritional insecurity through applied, collaborative, results-oriented research. CIFSRR is a program of Canada's International Development Research Centre (IDRC) undertaken with the financial support of the Government of Canada, provided through Global Affairs Canada (GAC). Phase 1 (2009-2014) focused on testing innovations, while Phase 2 (2013-2018) aims to both test scaling up methods/mechanisms and to scale up practical solutions to: increase food production, raise income for farming families, and improve nutrition. The emphasis in Phase 2 was to harness the best of the private, public and not-for-profit sectors to expand CIFSRR's research portfolio so innovations reach more people and have a greater impact globally to improve food security.

CIFSRR set the parameters of the Phase 2 research projects by requesting certain similar elements, such as a need to have: a team of diverse partners (including at least one private sector or business partner, at least one Canadian partner and at least one developing country partner) to scale up pilot-tested agricultural innovations; a scaling up plan; a business model with a proof of concept and value proposition; a gender strategy; rigorous research plan and methodology to test the scaling up; policy uptake plan; as well as a comprehensive exit strategy. All projects needed to address the three cross-cutting themes of the program: gender equality, environmental sustainability, and good governance. While the projects were autonomous, the strategic calls allowed for a level of consistency across the projects

While 18 projects were funded as independent projects in CIFSRR Phase 2 through competitive calls, the projects received significant group training and capacity building from IDRC over their duration, including specific workshops and mentoring on: scaling up, research methodology, gender integration, communications, and monitoring and evaluation. IDRC Program Officers provided specific support on the development and implementation of these strategies, through workshops and direct technical advice. The group workshops facilitated by IDRC also allowed opportunities for cross-project collaboration and the sharing of lessons.

This study

The Overseas Development Institute was commissioned to carry out a contribution analysis of the second Phase of CIFSRR, primarily to generate learning about the programme for the benefit of IDRC.

As part of this work, six research projects funded under CIFSRR Phase Two were selected for more detailed study in the field. One of those was Nepal Terrace Farmers and Sustainable Agriculture Kits (SAK) — from here on referred to as SAK Nepal.

The study aimed to assess the emerging results and impacts of SAK Nepal, to generate lessons from the experience. In more detail, the objectives were to:

- Examine the evidence of adoption of innovations developed and promoted by SAK Nepal;
- Assess the results of adoption and impacts upon incomes, food and nutrition security, and agricultural productivity in sustainable farming systems of target farmers and consumers;
- Look for evidence of impacts on other farmers and households;
- Assess the contribution of the CIFSRR project to the changes seen; and, to
- Consider the sustainability of the changes seen and the potential for scaling up, including the conditions that might promote such diffusion.

1.2 Introducing the project: SAK Nepal

SAK Nepal has its origins in an earlier CIFSRR-funded project, 'Revalorizing minor millets in rain-fed regions of South Asia' that ran from 2011 to 2014. LIBIRD led the Nepal field work for this programme, during which LIBIRD carried out participatory trials of agricultural innovations appropriate for the circumstances of the mid-hills of Nepal.

Aims of SAK

SAK Nepal was designed to test agricultural innovations for farmers in the mid-hills of Nepal and disseminate those found successful by farmers. In the mid-hills, land is scarce, much of it steeply-sloping and terraced, so that increased output must come from intensification of farming; yet migration by men means that women who remain in the villages have to do much of the farming, in addition to domestic work. Hence innovations need to be suited to the cultivation of narrow terraces; and should raise land productivity, save labour, or both of these.

Specifically, the project was expected to:

- i) test strategies that sustainably intensify terrace agriculture, including a neglected concept, farming on terrace walls which comprise 20-50% of hillside surface area;
- ii) test products that reduce female drudgery on terraces, and produce a picture book to share best practices with illiterate women;
- iii) test products that encourage sustainability, employing a Canadian biotech invention called GlnLux to maximise production of organic nitrogen fertiliser;
- iv) test and pilot products that help farmers develop more resilient farming systems, including use of biodiversity seed kits and smartphone extension technologies; and
- v) test empowerment strategies that encourage farmer experimentation and reduce dependency on government systems (e.g., self-production of certified seeds). [Project Approval Document, June 2014]¹

To scale up useful innovations, the project planned to work with private companies producing seeds and tools,

distributors of farm inputs, and retailers to make tested and proven seeds, tools and other equipment available locally to farmers. Retailers included dealers in agricultural inputs, farm co-operatives, and village corner shops selling snack foods and daily essentials.

Activities

The project was implemented by a Nepali NGO, Local Initiatives for Biodiversity, Research and Development (LIBIRD), in partnership with the University of Guelph in Canada. LIBIRD was established in 1995: it has considerable experience of combining research with practical development interventions in rural areas.

SAK Nepal undertook two major sets of activities. One consisted of development and testing of innovations for farming with farmers in two areas: Majhthana, Kaski District; and Jogimara, Dhading District (Figure 1.1). The other was working with a seed company, Anamolbiu, private agro-veterinary dealers, agricultural co-operative and village snack shops to stock and promote sales of the seeds, tools and other equipment needed for some of the SAK innovations.

Figure 1.1 SAK Nepal project sites



Source: Google maps

¹ In time the project was hoping to test the effectiveness of picture books as an extension tool. But at the time of this review, this activity had only just begun.

Characteristics of project sites

SAK Nepal focused its work with farmers in two village development committees (VDC)²: Majhthana in Kaski District and Jogimara in Dhading District (Figure 1.1). Majhthana measures 13 square kilometres, populated by 833 households, with a population of 2993 (1254 male and 1739 female) at the 2011 Census. Jogimara VDC has an area of 47.2 square kilometres, with 1442 households and 7744 (male 3842, female 3902) people (MPRC, 2013)

Both Majhthana in Kaski and Jogimara in Dhading are hilly, so that most agriculture is done on narrow terraces. Until recently, cropping was dominated by cereals: rice where water allowed, millet otherwise; complemented by some legumes and vegetables. Most crops were grown for home consumption.

In the last 10 years or so, vegetables for sale and other cash crops have been planted, in response to the increasing demand from growing urban markets, better access to those markets, and training from different organisations, including the government district agriculture development office (DADO).

For most of the sites in the VDCs, lack of irrigation is a major problem to use efficiently interventions from SAK. The sites are mostly situated on top of the hills making it difficult for farmers to use water from the rivers at the foot of the mountain, even though these rivers have water throughout the year, unlike the hill streams that only flow during the monsoon. The only other source of water is springs, many of which have dried up since the 2015 earthquake. People collect drinking water from these springs, but as the whole village depends on the same source, spring water is enough only for household use and not for agriculture. For some villages, such as Jogimara, a huge mountain stands between the villages and the nearest springs making it difficult for people to bring water into the village from nearby water sources.

Agriculture is still a very important source of livelihoods for people both in Kaski and Dhading. However, in Kaski, more and more people have taken up foreign employment in the Gulf countries and Malaysia in recent years. For example, in Majhthana, among 22 women in a group discussion, only one woman had a husband who had never migrated: 19 women had their husbands currently working abroad while the remaining two had

returned due to old age. Hence it is largely women who do the farm work.

In Dhading, on the other hand, foreign employment was less important. For example, among the 12 men participating in a focus group only one had been abroad for employment and only two of the elderly men had sons who were in foreign employment. Young people were more inclined towards commercial farming. They felt that one can earn the same from commercial farming, as from migration, without as much hard labour and risk. However, since not all were successful in growing vegetables for sale, a few respondents were making up their minds to go abroad. Other important occupations were driving — since the rural access road had been opened, teaching, casual labouring, labour works, running hotels along the highway, and petty trade.

The villages in the VDCs are connected to the main roads by dirt tracks: rough, with steep inclines, and not passable during heavy rains. Nevertheless, compared to before their construction, people report that it has become much easier for them to travel. For example, in Jogimara, a senior interviewee reported that in his youth, people had to walk for five days to Kathmandu where they sold their agricultural products and took home salt, cash and other things of daily use. Even though there are only fair-weather roads connecting the villages to the markets, people said that they could transport their products to the market as and when they wanted.

People sell their products to the local markets and nearby city centres. Market saturation does not seem to be the problem as farmers feel that demands for their goods are regular. For example, vegetables grown in the villages around Pokhara only satisfy 30–40% of market demand, the rest being imported from India. Farmers work with bus drivers, co-operatives, vegetable dealers in the city and the DADO, among others, to arrange transport to market. Some products from Majhthana such as chicken are still carried by people on their backs; while in Dhading, people carry milk on motorcycles to nearby markets. For other products such as chicken and goats in Dhading, buyers from the nearby towns come to the villages during festival seasons when demand is high. Mobile phones facilitate such visits.

municipalities. Under the new federal structure, Majhthana falls in Lekhnath Municipality and Jogimara in Benighat Rorang Rural Municipality.

² The VDCs were the smallest administrative unit in Nepal: formally they were abolished in March 2017 to be replaced by rural municipalities (*gaunpalika*) that amalgamate several VDC. There were more than 3,157 of the former VDC in all of Nepal, compared to just 481 rural

While farmers in Kaski sell their products directly to the wholesalers in Pokhara, those in Dhading sell to the brokers on the main road who come from Kathmandu and Pokhara. Farmers complained in Dhading that roadside brokers decided prices, taking a large margin. In Kaski, however, farmers felt that they could get fair prices.

People see lives as becoming better owing to better access to roads, improved agriculture techniques, modern tools, such as mills, lessening drudgery of household work, access to communications, education and health facilities as well as better respect of rights and less discrimination [Box A].

Box A Change in rural Nepal

Only a generation ago, the mid-hills of rural Nepal counted among the world's poorest places. With few roads and public services, the villages of the hills were largely given over to subsistence activities. Moreover, rapid population growth was making it ever more difficult for households to make a living, while leading to environmental harm of deforestation and soil erosion. The prospects were bleak.

[See, for example, Blaikie et al. 2002, Slayter-Thomas & Bhatt 1994 on livelihoods; Amacher et al. 1996, Metz 1991, on environment]

A generation later, things have improved. Once almost solely dependent on farming, rural livelihoods have been augmented and changed by the chance for men to migrate to cities, India, the Gulf and Southeast Asia. The opportunity to earn abroad and send back remittances has seen funds flow into rural areas as never before. In addition, some diversification of the rural economy has taken place, so that some jobs have been created in trading, retailing and transport, and some government posts such as teachers as well.

Most hill villages were, until very recently, only accessible by foot. Goods had to be head-loaded to and from the valleys and beyond where a market centre or road might be found. Subsequently, the government has bulldozed tracks to many villages. The road network has expanded from 2,700 km in the early 1970s to 44,000 km in 2016.

[<https://goo.gl/63dB7v>]

Rough they may be, vulnerable to the rains, but along these trails bus services are surprisingly common. [Six times a day to Majhthana and beyond.] The buses, moreover, are often packed. Villagers have much

greater interaction with market centres and major towns such as Pokhara than they ever did before.

A good range of public services can be seen in the villages: drinking water pipes are common; electricity seems almost universal; health posts provide basic services; and schools seem close to hand. The quality of these services may leave room for improvement, but they are now present. Villagers are, compared to the past, healthy and literate. The physical contrasts between grandparents and their grandchildren are striking. The seniors may be tougher, the survivors from hard childhoods; but their offspring are so much larger. [Compare DHS surveys from 1996 and 2016: stunting rates for children under five years in rural areas fell from 49% to 40%.]

The lives of rural women seem to be changing and to have changed enormously in the last two generations. Women have their own income, marry much later than their grandparents, and seem confident. Migration of men has had both empowering affects, but also sometimes created physical and psycho-social problems. Gender equality may not yet have been achieved, but much progress has been made; and perhaps progress on the more difficult issues such as changing gender norms — in a society where in the past rural women have been treated as secondary chattels to men. [View from women in focus groups]

Three implications of these changes stand out. One is that innovations in farming are no longer as important as they may have been. The ability to produce, for example, another half-tonne of grain is not necessarily critical to household food security. Many people in the participating communities can readily earn the cost of a half a tonne of grain, without spending many arduous hours in the field.

Two, the ability to innovate may be greater than before. Given expanded livelihoods portfolios and economic opportunities, participants can afford to take some chances, to invest a little more on their farms. They have better access to inputs and technical advice. Moreover, they have more incentives to do invest and innovate: if they can produce a surplus, they can probably get a decent price for it.

Three, even with these largely positive changes, the question of what households with access to very small farms can do — 'the 2.5 rupani [0.125 ha]

question³ — remains pertinent. The imperative is to find activities that produce very high yields per unit area. Farmers specifically asked about this. They are already carrying out many intensive operations that maximise the returns to land: stall-fed cattle, buffalo and goats, tomatoes and other vegetables under plastic, intercropped fields, bees, etc. That makes the question of how to intensify further even more pressing.

Sources: World Development Indicators, World Bank; Demographic & Health Surveys for Nepal 1996, 2016; Thomas-Slayer & Bhatt 1994, Amacher et al. 1996, Thapa & Weber, 1995, Metz 1991, Blaikie, 2002 et al.

1.3 Methods

The study was carried out by Anita Ghimire, rural sociologist, and Steve Wiggins, agricultural economist.

Having little more than three weeks to collect data, and seven days at project field sites, the method focused on obtaining as much relevant information as possible during that time. That meant that the selection of villages to visit was in large part determined by ease of access, those that could be reached by four-wheel drive vehicles over rough tracks. More remote communities that would have taken hours to reach were not visited. With observations only from the more accessible communities, they may not have been typical of what might have been seen in more remote locations. That drawback had to be traded off against the need to gain as much insight into what the project had done, to what effect, and how this was seen by participants as possible: in effect, opting for more detailed study of a limited number of locations, rather than trying to get a representative sample of locations.

Most of the information gathered was qualitative, most from field visits between 26 October and 2 November 2017. Some quantitative reports on project implementation, adoption and the results of field trials were available from LIBIRD. More specifically, information was gathered from the following sources:

- Project files including the project approval document and reports;
- Interviews with LIBIRD staff in Kathmandu, Pokhara and field sites;

- Interview with the project leader at the University of Guelph, Canada;
- Field visits to meet project participants in Majhthana and Jogimara, where interviews with individuals and groups of farmers, segregated by men and women were carried out
- Visits to two non-project villages to provide context and comparisons;
- Interviews with government staff and local authorities in the two project sites; and,
- Interviews with equipment suppliers in Kathmandu, Pokhara and at rural market centres along the Prithvi highway.

Appendix A lists interviews and discussions.

The study has some limitations. The most obvious is that this was a fairly rapid review of the project, engaging with a limited number of project participants who, as explained, may only have been typical of the more accessible villages. Nevertheless, the advantages of meeting at least some of the participants in their villages and fields was considerable: no matter how much has been documented and can be read, meeting with participants added a wealth of information.

Another limitation is that the review was carried out before the project has been completed, expected for February 2018. Hence the full results and impact could not be observed. To some extent, a subsequent reading of the final technical report from May 2018 helped to complete the picture.

When reviewing a wide portfolio of technologies, a bias arises for technologies that are highly visible, simple and with clear benefits. For instance, a hand-held corn sheller or a rake are simple tools whose uses and benefits are easy to appreciate. In contrast, crops planted along the edge of terraces are less easily spotted, and their diverse benefits — such as arresting soil erosion — are much less easily observed.

The rest of the report has two main sections. Chapter two reviews the project, setting out the theory of change. Evidence is then presented to assess progress on activities, changes to capacity and behaviour, results and impacts, following the causal chains in the theories of changes.

³ Farms in the project sites typically have no more than 2.5 rupani: just one 0.125 of a hectare. A generation ago, farms were typically 10 rupani: half a hectare.

The third chapter then assesses the project overall focusing on the key issues of sustainability and scaling up; the impacts seen on food and nutrition security, incomes and sustainable agriculture; and finally the contribution that the CIFSRF collaboration has made to building capacity, to policy and wider understandings.

2. Review of project

2.1 Theory of change

SAK Nepal's theory of change can be represented by a central narrative Middle column, Figure 2.1) that outline the expected sequence from project activities, to changes in capacity of project participants, to changes in behaviour and practice, and to impacts on welfare. The theory of change counts on actions by other agencies who are formally part of the project (left-hand column, Figure 2.1). The theory rests on assumptions about things the project cannot influence (right-hand column, Figure 2.1).

The heart of the project is the development and testing of agricultural innovations with farmers in the hills of Kaski and Dhading Districts. (Figure 2.1)

SAK Nepal is unusual in the number and range of innovations tested and promoted. LIBIRD with Guelph considered more than one hundred potential innovations, before settling on 46 innovations to test with farmers on their farms. The logic of this was that farmers who differed in their access to land, labour and capital, as well as their skills, preferences, and needs, would find different innovations attractive. Hence a wide menu of innovations was created.

Most agricultural development programmes, in contrast, focus on a narrower range of innovations, associated with drives to promote particular crops or livestock.

The other main activity (Figure 2.2) has been to work with private sector suppliers, importers, wholesalers, retailers and co-operatives to ensure that seeds, tools and equipment are locally available for farmers adopting the technologies. In the best of worlds, these actors would then become promoters of technologies., motivated by the promise of sales and profit.

Figure 2.1 Theory of change for testing and adoption of agricultural innovations

Enabling elements: actions by other parties	Central narrative	Assumptions to reach states on left
Public investment in roads, power, education, health, clean water, agricultural research and extension in rural Nepal	Impacts Improved welfare of farming households in Nepal's hill districts: <ul style="list-style-type: none"> • Higher incomes • Better nutrition • Less drudgery for women 	Macro-economic stability with economic growth Rural investment climate: no major disincentives to rural enterprise Political peace, law and order
	Results <ul style="list-style-type: none"> • Increased output for home consumption & sales • Time saved on labour-intensive operations 	
Scaling up: distributors stock tools, seeds, equipment <ul style="list-style-type: none"> • Anamolbiu • Agro-vet dealers • Hardware stores • Snack food corner shops 	Practice changes Reaction: Adoption of the most appropriate technologies by farmers	Farmers have enough savings and cash to buy seeds, tools and equipment Weather, pest, disease risks in usual range <i>[Irrigation lowers drought risk; intercropping reduces pests]</i>
Agricultural extension provided through DADO [MinAg]	Capacity changes: C: Farmers trained in improved techniques O: Markets for surplus produce, especially vegetables M: Less toil, more income, better food Reach: Hill farmers, especially women, Kaski & Dhading Districts, Nepal	C: Farmers reasonably healthy, alert O: Access to markets, growing urban economy M: Farmers prepared to make some effort for future betterment
LIBIRD implements programme in collaboration with Guelph and others Coordination with DADO [MinAg], NARC	Activity Research: agricultural innovation in labs, research stations, on-farm trials and demonstrations Testing farm innovations, including: <ul style="list-style-type: none"> • Terrace cultivation: intercrops and rotations with legumes; terrace wall climbers; yam sacks • Soil fertility management: manure shading and application, animal urine enhancement • Irrigation: plastic ponds, drip pipes • Plastic greenhouses and poly-tunnels for vegetables • Farm tools: fruit picker, jab planter, rakes, fork weeder, gloves, knee pads; power tiller • Processing & storage aids: maize sheller, electric millet thresher; hermetic grain bags • [Planned but less successful: hybrid maize breeding, fertiliser micro-nutrients, rhizobia inoculation of seed] Scaling up Picture book, other documentation of techniques including papers and presentations Private sector distribution: see Figure 2.2	

Notes: C = capabilities; O = opportunities; M = motivation

Figure 2.2 Theory of change. Scaling up through commercial distribution

Enabling elements: actions by other partners	Central narrative	Assumptions to reach states on left
	Impact Availability of seeds and tools allows farmers to innovate [to main theory of change]	
Rural investment climate: no major disincentives to rural enterprise Public investment in roads, electricity	Results Sales of seeds and tools in Nepal’s hill districts	Macro-economic stability with economic growth Political peace, law and order Farmers have enough liquid cash and savings to buy kits
	Practice changes Reaction: Retailers stock items in the SAK	Retailers prepared to try new products, take risk of low sales and unsold inventory
	Capacity changes: C: Retailers aware of SAK items and uses O: Sales to farmers, attract custom in general M: Higher sales, profit Reach: Retailers, Kaski & Dhading Districts, Nepal	C: Retailers understand basics of agronomy, know their customers O: Farmers want to take up SAK innovations: see main theory of change M: Dealers want profits
•	Activity Collaborate with Anamolbiu as key distributor of seeds, tools Retail distribution: engage and train retailers <ul style="list-style-type: none"> • Agro-vet dealers • Hardware stores • Snack food corner shops • Agricultural co-operatives Mobile phone consumer survey	

2.2 Testing the theory of change

This section traces through the two linked theories of change, assessing activities, changes to capacity, behaviour changes and their results and impacts; starting with the agricultural innovations, then looking at distribution of SAK items.

2.2.1 Trials of agricultural innovations

Activities

LIBIRD with Guelph had considered as many as 145 different innovations that might be appropriate for hill farmers. Of these, 46 have been tested (listed in Appendix B). Some 20 innovations have been selected for scaling up; another 10 are pending further tests; and

16 have been dropped since they did not find favour with farmers.

SAK had tested the tools and has documented response for the acceptance of tools. Tools were tested among 438 farmers in the year 2016 and among 530 farmers in 2017 in the two project sites.

The selected and pending innovations can be divided broadly into two groups:⁴

- those that primarily **raise yields per unit area and increase production**, including: [*pending innovations in italics*]
Vegetable production — packs of composite seeds; legume seed kits; plastic (silpaulin sheets) ponds to

and soil erosion. They also divide the innovations into practices and those embodied in products.

⁴ LIBIRD have a slightly different set of categories also defined by purpose of innovation: female drudgery, limited land area, mechanisation in narrow plots, low productivity,

harvest water; drip irrigation; plastic houses and poly-tunnels;

Manure management — cattle sheds constructed to facilitate manure removal; shading of manure from sunlight; collection of cattle urine; application of manure at time of crop planting;

Planting on terrace walls — yams grown in sacks; *pumpkins with creepers trailing over terrace walls*;

Crop rotations — intercropping of maize-ginger-soybean, millet-soybean, mustard-pea, maize-cowpea, *maize-bean*; planting crops along terrace edges, such as rice beans, *cowpeas*, *horsegram*; winter legumes, such as pea, planted in relays;

Seed production and treatment — hybrid maize seed; *seed treatments*; *rhizobium inoculation of seed*; and

- **Innovations to save labour time** and sheer drudgery, including:

Field operations — farm rake; fork weeder; fruit picker; gloves; *mini-tiller*; *jab planter*; and,

Post-harvest processing and storage — hand-held corn sheller; electric millet thresher; hermetic storage bags; *electric corn sheller*; *maize and pulses grinder*.

During the field visits, less was heard and seen concerning innovations to improve the environmental sustainability of farming. That said, some of the innovations being promoted potentially make farming more sustainable. For instance, intercrops and crop relays, and manure management can all improve soil fertility without resort to manufactured fertiliser; while edge crops and terrace wall crops may protect against soil erosion. Moreover, during the field visits farmers in Majhthana and Jogimara mentioned the drawbacks of heavy use of chemical fertiliser (soil coarser, acidic), and of pesticides (food not safe). They were clearly concerned to reduce the use of these inputs. So too was the district agricultural officer for Kaski.

Although assessing project delivery was not the focus of the study, the amount of activity undertaken in the two areas visited was impressive. The LIBIRD field teams

had clearly worked hard with farmers to select and test suitable innovations; and to document the experiences.

The staff met were enthusiastic and engaged with the challenges faced by farmers. Of the five field workers met, four were women which helps when SAK is seeking to work with women farmers in particular.

Capacity, behaviour changes and results

The farmers met had tried and tested a wide range of innovations. Most of the innovations were understood.⁵

Farmer responses to different innovations have varied, as might be expected given the range of circumstances of households — labour, skills, capital; and the physical conditions of their farms. Hence the decision to offer a long menu of innovations has been wise.

Innovations to raise yields

It was clear in visits to the sites, that most of the selected innovations to raise yields were being used.

The most dramatic of these were **plastic houses**: sheets of transparent plastic stretched over a lattice of poles to create a simple greenhouse that created improved conditions to grow vegetables. They covered up to 60 square metres. Combined with **drip irrigation**, these could then be used in the dry, winter off-season when fresh vegetables were most valuable on the market. The critical point was a supply of water. Where, as applied in most of the ridgeline villages, no flowing water could be captured for irrigation, then water harvested from roofs and land, captured in artificial ponds lined with silpaulin (a type of tarpaulin) sheets, could provide water for a plastic house.

Farmers reported that they would typically consume a quarter of the greenhouse's produce at home, then sell the rest. In both sites, marketing was relatively straightforward. Majhthana lies little more than 20 kilometres, albeit along a rough and twisting track, from Pokhara, a city that has ample demand for local vegetables — it often imports supplies from India. Jogimara lies immediately south of the main Prithvi highway connecting Pokhara and Kathmandu. Most villages in Jogimara lie within ten kilometres of the main road: once there, brokers arrange shipments to the cities.⁶

the money to the bus driver who would then pay the farmers on the evening run back.

In Jogimara, farmers complained that the road-side brokers were setting prices and taking an excessive cut of the price. Even where the farmers had formed a cooperative to sell the vegetables, the same complaints

⁵ A part exception was rhizobium inoculation, where one interviewee had an explanation of its function, but not that accurate an understanding.

⁶ In Majhthana, farmers were able to send tomatoes in crates to Pokhara on the morning bus: a trusted broker would meet the bus in town, sell the tomatoes, and give

Vegetable growers could get competitive prices for vegetables grown, above all tomatoes. For example, in Majhthana, it was possible to grow 300 kg of tomatoes in 3–4 months under 50–60 square metres of plastic. Selling 75% of the crop in Pokhara would generate around US\$100.

Packs of **composite vegetable seeds** were an enigma. These packs consisted of small quantities of 6 to 10 different vegetables, chosen for their range of micro-nutrients, and intended to plant a home garden. Few farmers interviewed mentioned these. As will be seen in the next section, they have not sold particularly well with agro-vets either. It seemed that farmers preferred to buy small packs of specific kinds of vegetables. Yet, the composite seed packs are seen as a success by LIBIRD; and more than 2,000 have been sold.⁷

Plenty of evidence was seen of better management of **farmyard manure**, with heaps shaded from the sun, and farmers reporting that they now applied the manure only when they planted the crop. Some farmers had dug and lined small pits to collect cattle urine to add to drip irrigation water.

Many farmers — in one Jogimara group of women farmers, 30 out of 35 had tried this — had started to plant **yams in sacks** along their terrace walls, although this was usually being done on a small scale, covering up to 20 metres of a wall, rather than substantial lengths of the walls. Women farmers liked this idea, since the yams tended to grow straight in the sacks, and, above all, they could be readily harvested by tearing the sack; rather than being dug out of the ground, an arduous procedure often left to males.

Sacks were typically yielding 7 or 8 kg of yam. The yams were consumed locally — especially during festivals in December–January, either boiled in a curry, or eaten as snacks. They could also be sold: 8 kg of yam could be worth US\$1.50.

Farmers visited were trying **inter- and relay-cropping**. They reported that they harvested more in total from their fields than when they harvested just one crop. The trials carried out by LIBIRD indicate that substantial increases in yields, and in financial value of production can be achieved (see Appendix C). Of nine different combinations tried over two seasons in the two sites, only three produced insignificant or negative increases in total grain harvested compared to control plots of

were made since the cooperative staff were alleged to collude with the brokers.

⁷ It seems that there is large market for the composite seed packs with development projects, above all those

monocrops: for the other six cases, increases in weight of grain were in the range 16–50%. Given, however, that the intercrops were valuable legumes, the value of production increased by more than the weight gains: for the six successful trials, increases ranged from 35% to 166%.

One woman farmer in Jogimara reported that she had been planting ginger among the maize, then after the maize was harvested, was relay planting peas with spinach. From a small plot of around a tenth of hectare, she had been able to sell 60 kg of ginger, worth around US\$30.

The only innovations for enhanced yields where changes were not seen during the visits concern the production of hybrid maize seed, treatment of seed and rhizobium inoculation. Of this cluster of innovations, farmers in groups only mentioned trials of rhizobium. Even so, it seemed no-one had adopted this, even if they had seen the field trials.

Most of the innovations to raise yields required farmers to change practices, in some cases increasing their labour time. Cash expenses were limited in most cases, with the major exception of the plastic houses with drip irrigation. The plastic sheeting could cost between US\$60 and US\$150, depending on size. Although thus a major investment, many farmers in Majhthana have bought these from commercial dealers in Pokhara — perhaps unsurprisingly, since the cost can be recuperated by the first harvest.

By late 2017, SAK records were of 1,210 households adopting seven of the most popular innovations — yams in sacks; maize-cowpea and ginger-maize-soybean intercropping; plastic greenhouses with drip irrigation; improved cattle sheds and farmyard manure management; legumes on terrace wall (rice bean, horse gram, black gram); and pumpkin on terrace wall. Another 1,572 households outside of the project sites were estimated to have taken these up as well.

Innovations to reduce labour time and drudgery

Development and dissemination of innovations to save time, labour and drudgery is one of the chief objectives of SAK. LIBIRD with Guelph has selected tools, drawing chiefly upon those either already in use in other parts of Nepal or in India and China.

concerned with relief and rehabilitation. For procurement managers, it convenient to buy the seeds in a single pack, rather than having to buy many different packs of seed.

In the intervention areas, these tools were given to women's groups for free; while in scale-up areas, they had to be bought at a 50% subsidised rate. In the case of the hand-held corn sheller, each tole (group of 5–7 households) got one. The idea was that after testing, the households would buy those tools by themselves.

LIBIRD conducted a participatory ranking with farmers of the most prominent innovations where seeds, tools or other equipment had to be bought. (Table 2.1).

This shows that the highest-ranked innovations were those that were relatively simple; where small technical advances lead to clear benefits. Men and women scored the innovations significantly differently. Women, for example, had much higher preference than men for the mini-tiller, since this allowed them to prepare land without having to rely on men to plough; for one of the jab planters, because this avoided the need for constant bending; and for the silpaulin (a type of tarpaulin) sheets that were used to make water ponds that saved much time and effort for watering livestock, and could also serve as a source for drip irrigation.

Interviews with farmers, most of them women, individually or in groups broadly confirmed these results (Table 2.2) Of the tools that most commonly been accepted, it is because they save labour and drudgery.

For example, women in Majhthana said that previously shelling corn using just their fingers and thumbs took months. Women worked on the corn cobs at night, or during the day in their free time. However, with the **hand-held corn sheller**, the work has been done within weeks. An alternative to finger shelling was to thrash the corn in sacks; but the process was messy, so that much time was then spent cleaning up, while women tired easily. With the corn sheller, women have solved these problems.

Similarly, given a **farm rake** the younger generations now help in cleaning the cowsheds which they would not do before.

Table 2.1 Farmer ranking of innovations requiring seeds, tools or equipment

Product	Advantage	Observability	Trial ability	Simplicity	Compatibility	Affordability	Total	Male Farmers	Female Farmers	Female- Male Difference
Hand-held corn sheller	9	9	9	9	9	9	54	54	54	0
Composite vegetable kit	9	9	9	8	9	9	53	51	54	3
Fruit picker	8	9	9	9	9	8	51	54	48	-6
Gloves	8	8	9	9	9	9	51	54	48	-6
Super grain bag	9	9	9	9	9	6	51	51	51	0
Silpaulin sheet	9	9	6	7	9	9	49	44	54	10
Electric corn sheller	9	9	7	9	8	5	46	44	48	4
Farm rake	6	6	9	9	8	8	45	45	44	-1
Fork weeder	6	8	8	9	8	8	45	47	42	-5
Millet thresher	9	9	5	5	9	6	42	39	45	6
Mini-tiller	9	9	4	4	4	6	36	29	42	13
Maize/pulses grinder	3	9	4	6	8	6	35	37	33	-4
Jab planter	6	8	3	6	5	2	29	23	35	12
Jab planter (tube type)	2	4	2	6	5	3	21	27	15	-12
Table type corn sheller	2	6	3	2	4	2	17	16	18	2

Source: LIBIRD

Table 2.2 Farmers' acceptance of SAK tools

SAK Tools	Acceptance	Remarks
Corn Sheller	Most widely accepted	The most popular among SAK tools, with households buying one except for a few cases where one neighbourhood has one for sharing. Women taking it as gifts while visiting extended family members.
Gloves	Widely accepted and popular	People buying it for households. Farmers liked it as it prevented their hands from injuries and being dirty.
Hermetic grain bags	Well accepted in both the sites by those who have used it	Those who have used it have found it to be useful but not all people have bought it.
Lentil grinder	Well accepted by users	Not everyone had used it so far, but was well accepted by people who used it and more people are willing to buy one.
Power mini-tiller	Widely accepted	Since it is costly, people are looking for free samples or subsidies. Also, people will be buying it in community groups rather than individual. Women would prefer lighter models; and those with a starter motor. They even wondered whether a tracked model existed ⁸ that might be able to move from terrace to terrace.
Millet thresher	Widely accepted	Examples were given to a few communities only. It is widely accepted but people would like to have it with modifications such as easy transportation. Also, people will buy it in groups rather than individually and only if they get it on subsidy.
Farm rake	Well accepted	Not everyone has used it in both sites. People who have used it have liked it. They have asked for ones with no handle which are less expensive as they think they can fit wood handles at home.
Fruit picker	Not very popular	Not everyone seems to have seen it in both sites. Those who used the sample have found that it makes fruit picking easy but have not thought about buying one — the main reason being that fruit is not a major crop.
Jab planter	Not very useful	Respondents in both the sites have seen it but it is less likely that they will buy it. They will use it only when tillers fully replace manual ploughing as manual planting is more appropriate when plough is used.
Knee pads, belts	Not a priority	These were seen as luxuries, that they could do without.

Source: interviews with groups of farmers

⁸ They do indeed exist, but probably come with a weight penalty: one model weighs 90 kg.

Trained by SAK Nepal to use the **power tiller**, women have become confident in using the machine. Women would, however, like some modifications to the tillers. They were concerned that they could not operate the recoil starter; they also wanted lighter models; and wondered if there was a tool to aid moving power tillers up and down terraces.⁹

Time savings were not the only advantages of some of the tools. For instance, with the **gloves**, people face less risk of their hands getting cut or pierced by thorns; using gloves **and rake** together means they do not have to get their hands rough and dirty even when cleaning cowsheds.

While some tools, by saving labour time, would also reduce costs; some did not. For example, the cost to till a hectare of land was the same for both ploughing with oxen and using power tillers.

Impacts

The technologies adopted were having the intended impacts in the project villages. The increases in incomes accruing from increased production in the poly-tunnels, from terrace wall crops, intercrops and relay crops have been noted in the preceding section.

The tools designed to save labour and drudgery have also achieved their goal; again, as noted above.

Moreover, indications suggest that SAK Nepal is contributing to food and nutrition security. Most of the additional produce, some of which is consumed by the household, is of food rich in vitamins and minerals. Very probably this would improve nutrition, especially since the villages showed evidence of improved sanitation and clean water in recent times.

Beyond the main expected impacts, women farmers appreciated the way that some innovations lessened their dependence on men.

For example, power tillers have reduced women's dependency on men for land preparation. Local norms prohibit women from ploughing fields in Nepal; yet women reported difficulties in hiring labour for ploughing — ploughmen not available, coming late, not working properly — when their men were absent. No such restrictions apply to women using power tillers, so they have taken up the mini tillers, thus sparing the need to hire ploughmen.

Independence for women farmers from male labour was also evident in the yam sacks described in the previous

section. Women no longer needed men for the heavy work of digging yam out of the ground.

2.2.1 Scaling up through commercial distribution

Activity and implementation

Again, although implementation was not the focus of this study, it was clear that LIBIRD had done much to carry out its plans of working with Anamolbiu as a distributor of seeds and tools, and with co-operatives, retail agro-vets and snack food vendors to make available locally the necessary inputs to support the innovations.

Anamolbiu as a private company with a social mission, originally set up by LIBIRD, was clearly much engaged with SAK Nepal. It was producing seeds for the legumes recommended in cropping systems, including composite vegetable seed packs for home gardens. It was importing —mainly from India — and distributing hand-held corn shellers, rakes and hermetic grain bags. The company had tried gloves, but special, tough gloves are costly. It hoped also to distribute plastic sheeting as well.

Anamolbiu competes with as many as another 100 seed companies in Nepal. Its commercial strategy is quality: to distribute seed of the most appropriate, proven varieties, true to type with high germination rates. It seemed that they had adopted the same quality-first strategy for the few tools they distributed as well.

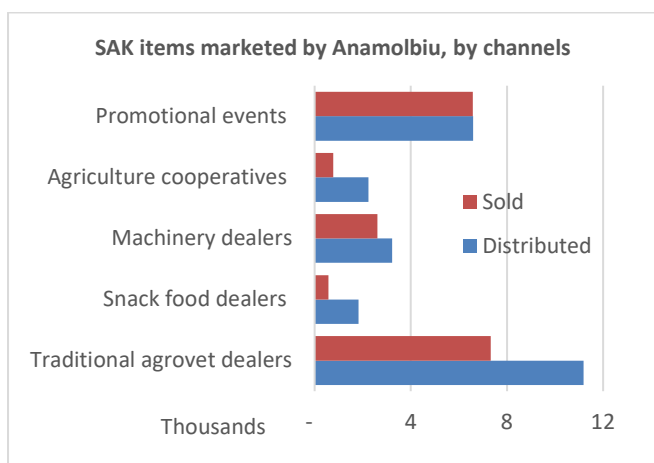
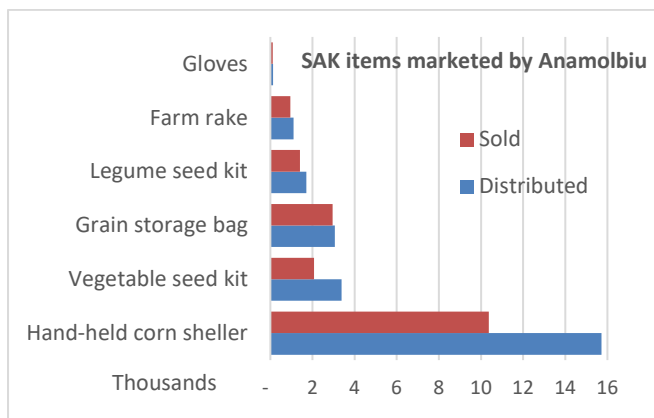
Around 11% of Anamolbiu's revenue in most recent year comes from sales of SAK items, including sales to NGOs. A substantial proportion of Anamolbiu's business, this should give them the incentive to sustain SAK sales.

By far the largest-selling item of Anamolbiu-sourced kit was the hand-held corn sheller (Figure 2.3). Vegetable seeds and grain storage bags had also sold in significant numbers, although many vegetable seed kits were yet to be sold.

⁹ Since operating the recoil starter was so difficult for women, they reported manually lifting the power tiller

from terrace to terrace *with the motor running*. Fortunately, this had yet to lead to a serious accident.

Figure 2.3 Sales of SAK items distributed by Anamolbiu, late 2017



Source: LIBIRD records

Capacity, behaviour changes and results

The main channels for distribution have been the agro-veterinary supplies dealers, followed by promotional events, such as agricultural fairs. Sales through agricultural co-operative had been limited; while the idea of distributing through snack food kiosks had barely had any effect.

Visits to agro-veterinary supplies dealers in small towns close to the project sites showed that Anamolbiu had succeeded in getting them stocked with the seeds recommended: in most cases, the shops also had corn shellers. It was rare to find other items. The agro-vets reported that their main sales were feed for chickens, vegetable seeds, fertiliser, pesticides: all items with a ready turn-over and repeat sales. They were mainly serving peri-urban farms that specialised in intensive livestock and vegetables.

¹⁰ While the proximity of the two industrial neighbours may inhibit Nepali industry, it does mean that Nepal can get all the supplies it may need, at low cost. Moreover, the factories of China and India are well used to producing equipment designed for small farms — and increasingly farms short of labour; the equipment also being rugged

Most of them reported that the corn shellers sold well, especially when advertised or otherwise promoted. The composite feed packs, however, were in low demand. They competed with the very many small packs of seeds of specific vegetables stocked: usually the agro-vets stocked seed from half a dozen or more companies, so that Anamolbiu’s seeds faced considerable competition in store. The dealers were motivated by profit: they had taken SAK items on sale or return from Anamolbiu, so that any unsold items would be going back to the company; presumably either not to be restocked, or ordered in lower numbers in the future.

Agricultural co-operatives had not been a major channel, since it seemed that they were only open to sales on particular days and hence lacked the convenience of the agro-vets who were open most working days.

For snack food vendors, the SAK items were not that attractive. They were tiny businesses dealing in items sold daily: farm tools and even seeds were too infrequently demanded to make them an integral part of their businesses.

An overall problem faced with distribution is that some of the SAK items are so infrequently bought. The hand-held corn shellers, for example, were ruggedly constructed and likely to last years before needing replacement.

When Nepal SAK was first planned, it had been thought that some items could be manufactured either locally, by for example village blacksmiths, or by domestic industry. Neither of these ideas has come to fruit. Factory manufactured tools, imported from India and China, were cheaper than anything local smiths could make. Few industries within Nepal could compete with the imports.¹⁰ One exception was a small workshop in Kathmandu that was manufacturing millet threshers to order, with specifications adapted to Nepali conditions.

All the tools and equipment to save labour are produced industrially and have to be bought. SAK Nepal has provided samples of the tools to groups to test. In some cases, farmers have been willing to then to buy the tool themselves: that applies above all to the smaller, cheaper items, with hand-held corn shellers¹¹ and gloves

and basic, since their customers look for low-cost options that will need low maintenance.

¹¹ Even so, in one village women in a group said that they shared the corn sheller among the *tol* — cluster of 7–8 households — to which they belonged.

good examples. Generally, the cheaper the tool, the more likely it is to be bought.

Commercial distribution had also run into two other problems. One was public subsidy of farm machines and free distribution of seeds, tools and equipment. The government offers a 50% subsidy on the price of farm machinery to smallholders.²² This apparently was not an automatic right, but farmers could apply for this with the expectation that in time they would get the subsidy. Moreover, some of the tools could be obtained from the district agriculture development office, if a farmer group got together and applied for it. Furthermore, we heard of a misunderstanding that some of the equipment such as grain bags would be provided free of cost to every household in due time. Given these alternatives to buying from private dealers, people were reluctant to spend money on tools at commercial rates.

Two, the agro-vets reported that most of the smaller-scale farmers who came to their shops went for price rather than quality: they looked for the cheapest supplies, rather than being prepared to pay for higher quality. Moreover, there is problem with retail distribution: retailers are reluctant to pay more than what they paid the preceding year for their stock, yet for distributors the import prices often rose, exacerbated by frequent strikes, blockades and shortage of fuel.

Impacts

Impacts expected for commercial distribution of seeds and tools were less than expected; with the considerable exception of the hand-held corn shellers.

The promise of commercial distribution can be realised for some products — those that are technically simple, low cost and with a clear benefit. But for other technologies, other channels are needed to promote diffusion.

2.3 Reach and scale of SAK Nepal by April 2018

By the conclusion of the project in April 2018, more than 1,000 farmers had tested one or more of the most popular agronomic innovations of SAK Nepal (Table 2.3). Of these farm households, 74% had adopted the practice, with rates for individual advances ranging from 50% for growing yams in sacks, to all of those who had tried the improved cattle shed with management of farmyard manure.

The project teams estimated that another 924 households had adopted practices through contacts with the SAK participants. In addition to that, innovations promoted by SAK had been tested in other sites through the efforts of government and NGOs, reaching another 2,137 households. In total, then, the SAK Nepal team estimated that the innovations had reached and been taken up by more than 3,800 households in total.

Sales of tools and products had reached many more households (Table 2.4): more than 56,000 in all. Sales were dominated by seeds and the hand-held corn sheller. Two channels had provided most of the tools and products: the agro-vet dealers, and distributions by the government and NGOs.

²² It was mentioned that under some priority development schemes, this could increase to as much as 85%.

Table 2.3 Selected agronomic practices and the status of their scaling up.

Practice	Test farmers	Households continuing the practice	Farmer to Farmer	Households outside test sites (party supported by government or	Total households following SAK practices	
Legumes on terrace edges/wall — rice bean, horse gram, cowpea	350	238	68%	125	661	1,024
Yam growing in sacks	119	59	50%	196	462	717
Maize + cowpea intercropping	141	129	91%	118	228	475
Ginger + maize-soybean intercropping	59	58	98%	90	278	426
Water harvesting + Drip irrigation + Plastic house	70	58	83%	206	124	388
Pumpkin on terrace wall	151	100	66%	84	101	285
Mustard + Pea intercropping	50	36	72%	45	151	232
Improved cattle shed and farmyard manure	72	72	100%	48	102	222
Millet + soybean Intercropping	45	32	71%	12	30	74
TOTAL	1,057	782	74%	924	2,137	3,843
				3,061		

Source: Table 5, Final Technical Report, April 2018 [Pudasaini et al. 2018]

Table 2.4 Sales of SAK tools and products until December 2017.

Item	Agro-vet	Snackfood dealers	Utensil/hardware stores	Co-operative	Exhibitions /Events	GO/NGO	Self- paid	Total households
Vegetable kit	4,106	45	0	310	160	20,987	4,621	25,608
Corn sheller	9,350	525	2765	805	1483	3,646	14,928	18,574
Legume kit	5,025					160	5,025	5,185
Super grain bag	301			150	4	3,700	455	4,155
Farm rake	657	54	20	35	53	1437	819	2,256
Gloves				27	63	476	90	566
Silpaulin	16	1				64	17	81
Drip irrigation kit						20	0	20
Total	19,455	625	2,785	1,327	1,763	30,490	25,955	56,445

Source: Table 6, Final Technical Report, April 2018 [Pudasaini et al. 2018]

3. Analysis

3.1 Research partnership and policy influence

3.1.1 Research partnership

CIFSRF has made at least two major contributions to SAK Nepal. One has been the partnership between the Canadian universities, led by Guelph, and the local partner LIBIRD. Interviews with the leader in Guelph and the senior staff at LIBIRD report that this has been highly fruitful. It seems that there has been a meeting of minds between the Canadians and Nepalis, the result being a project that has repeatedly done things that are ambitious, innovative, and not that often seen in development projects.

For example, at Guelph students have been used to trawl websites in China and other countries to identify tools that might be applicable in the hills of Nepal. The more promising items were imported to Canada, tried in Guelph, then taken to Nepal. The leader in Guelph has challenged his students to become engaged and to imagine what might be done. At least two contributions of young Canadians have been exceptional. One is the collection of YouTube videos that present the various innovations that have been tested and found successful. A Canadian graduate student was given outline guidance, went to Nepal and shot the films largely as he best conceived them. The resulting films are exemplary in content, production, communication: they look to be the work of an experienced professional, rather than a talented beginner.

A second remarkable contribution is the drawing of the picture book illustrating the proven practices. Nothing so much captures the nature of the collaboration seen under SAK as the way this was done. A young Canadian illustrator was hired. Under Guelph leadership, she drew the lessons in the book. Then, and here the partnership is seen at its best, the illustrations without text were sent to Nepal where they were field-tested with groups of women farmers. The farmers commented on each and every page: more than 500 edits were sent back to Guelph for the illustrator to finalise. As a result, the picture book is both visually attractive, as well field-tested.

The partnership has been marked by a profusion of innovations, with a willingness to try all manner of ways to help test and disseminate useful farm techniques. Not all have worked: the hope that snack food vendors would prove a major channel to get seeds and tools to farmers has not been realised; similarly, agricultural co-

operatives have not proved that useful for diffusion either. But many things have indeed worked.

In large part, the partnership has functioned because both parties are imaginative and capable. LIBIRD, for example, prides itself on thinking about its work and taking research seriously, rather than just being an implementing NGO. LIBIRD senior staff report that they are often approached by young graduates seeking work experience, anxious to work with LIBIRD even if pay might be better with rival agencies, because they know they will learn a great deal.

The partnership has contributed to the level of energy and activity seen. This was readily visible in the villages visited. The field teams clearly have worked long and hard to test ideas with the participating farmers. The same can be seen at the more senior levels, where it seems that key personnel have done far more than could reasonably have been expected from the resources they had.

The interactions between the Nepali partners, Canadian colleagues and IDRC desk officers has produced an impressive synergy: virtually a model for what such a relationship could be. This is not always that simple to realise: indeed, the potential for shared responsibilities to result in burdensome coordination, and even to time-consuming and morale-sapping disputes, is a risk to such arrangements. That this has not happened in this case, that the opposite has been achieved, speaks volumes for the talent and commitment of the respective parties.

The second major contribution of CIFSRF has been the active support of IDRC desk officers. The degree of engagement of the desk officer and others in IDRC with the project was rated by the SAK team as exceptional. That engagement has gone well beyond an active interest, but also a source of useful suggestions, additional funds, and help to revise project programming when the programme had to react to an import blockade by India, and the 2015 earthquake.

Both Guelph and the LIBIRD team have appreciated the flexibility of the CIFSRF grant. Given the nature of the project, in developing, adapting and testing technology, a blueprint would have been a straightjacket. LIBIRD have had the freedom to react to the learning that has emerged in the project: they have used this to very good effect.

SAK Nepal is in many respects an exemplary rural development programme. That is almost entirely down to the calibre of the leadership of the partners, and the dedication and talent of the project staff in general. This has been made possible by IDRC. CIFSRF's funding

modalities have attracted bids from organisations as capable as LIBIRD and Guelph have shown themselves to be; while support by IDRC staff to the project after approval has allowed the partnership created to flourish.

3.1.2 Policy influence

SAK Nepal is a relatively small agricultural development programme, especially when compared to programmes funded in Nepal by the major multilateral and bilateral development partners. Yet it has been able to attract national attention.

LIBIRD has active contacts in the government of Nepal. For example, when a workshop was held to present the project, both the minister of agriculture and the prime minister were present. LIBIRD also talks to members of parliament. In Kaski District, the district agricultural office (DADO) were well aware of SAK Nepal.

Engagement with policy-makers has had at least one unexpected outcome: the ministry of agriculture was so taken with the hand-held corn sheller, that they promoted it nationally—but with a subsidy, thereby rather undermining the SAK strategy of commercial distribution.

On wider understandings, SAK Nepal has an impressive list of publications, either published, in draft, or planned, with more than forty contributions, the majority of these are in the natural sciences, documenting the science of the innovations.

Although SAK Nepal has cast a wide net in the search for appropriate innovations for the hill villages, a couple of sub-sectors have not received much attention.

One of those is livestock. The amount of livestock on the hill smallholdings is striking. Not only do they provide valued produce, but they help maintain soil fertility, as the manure they produce concentrates nutrients from fodder gathered from beyond the field boundaries. SAK Nepal has hardly any innovations to improve livestock yields. The programme could expand its repertoire to include more livestock improvements. One starter would be to look for ways to substitute home-produced feed for purchased chicken feed.

Fruit is another sub-sector that has been relatively ignored. Apparently, fruit development is not popular with donors in Nepal because of the time taken to develop fruit trees. But that is no reason to side-line fruit.

Given the importance of raising value of output per unit of land in areas where few farmers have access to more than half a hectare of land, it would be good to estimate formally the returns per unit area of highly intensive

farming. Given the investment in plastic houses and drip irrigation that farmers have made, which crops give the highest returns per area becomes a key question. While tomatoes can generate earnings of US\$100 a season from 60 square metres in Majhthana, from neighbouring Begnas came a report of a farmer who earned US\$800 from cucumber grown in a plastic house. Capsicum might give an even higher return, according to a LIBIRD specialist, although cultivation is more demanding. Given that Nepal imports flowers from India for festivals, even cut flowers might be possible for villages with reasonable access to markets.

Simple gross margin analysis would provide some guidance on selecting crops with ultra-high returns per unit area.

3.2 Specific outcomes

3.2.1 Food & nutrition security

As an agricultural development initiative, SAK Nepal promotes innovations that lead to higher production of food on hill farms, a good part of which arises in foods that are relatively rich either in vitamins and minerals, such as vegetables, or in protein as applies for legumes. Even if some of this produce is expected to be sold, some is kept for home consumption.

Indeed, cellphone surveys of buyers of SAK seeds and tools, showed that 26% of buyers reported women and children increasing vegetable consumption. Other reports have 1,000 households growing legumes on terraces edges producing an average of 40 kg more, almost all eaten at home.

Hence SAK Nepal contributes to more diverse diets, with higher intake of micro-nutrients.

All other things being equal, the nutrition of participating households should improve from a better diet. The potential stumbling block would be poor health conditions that prevent people, and especially young children, from turning a better diet into growth and better physical functioning. Given investments in clean water and sanitation in the villages visited—most households had access to piped water, while toilets seemed to be in widespread—it would seem the health environment is improving, thus making a better diet all the more effective. The SAK picture book also includes lessons on diets for pregnant mothers and children.

In as much as the hill villages supply additional produce, especially vegetables, to local markets, then the local population in general will benefit from greater availability of nutritious food; and possibly at lower prices than would otherwise have been the case.

3.2.2 Income

Several agricultural innovations raise production of crops through higher yields, intercropping, or use of previously unproductive land, such as terrace walls. Some of that increased harvest is then sold, with yams, ginger and some vegetables as typical items sold.

Most entail modest earnings, of US\$30 a season or less. For example, crops grown along terrace walls can be worth US\$5 a sack for yams, US\$54 per chayote plant; and US\$54 per pumpkin plant. For crops grown along terrace edges, in Kaski farmers were harvesting another 7 kg of rice bean, worth US\$14; while in Dhading, an extra 10 kg of the same crop was worth US\$19, with similar returns to cow peas and black gram. Intercropping trials with farmers showed increases in economic returns ranging from 11% for ginger-maize-soybean to 154% for millet-soybean.

These income increases are quite modest. In 2010/11 the Living Standards Survey for Nepal estimated that households in the rural hills central of Nepal consumed the equivalent of US\$2,270.¹³ Although modest, such increases go for the most part to women farmers who otherwise have limited access to cash, other than by asking spouses and other male adults.

One technical package, however, can generate much larger increased incomes: polythene houses and tunnels with drip irrigation can generate net gains over costs of equipment of US\$200 over three years and six seasons, for a 50 square metre cover. Even more may be achieved, either by very careful management of the crops typically grown under plastic — tomato is currently the most common choice — that can generate high physical yields; or by growing other vegetables with even higher financial return, such as cucumbers and peppers (capsicum). Indeed, one informant thought that if he could successfully use a polythene greenhouse to grow vegetables, he could make enough to rival his expected earnings, net of travel costs, from migration out of Nepal.

3.2.3 Sustainable agriculture

Many of the SAK innovations were designed to raise production, either by making use of underused land such as terrace walls and risers, through raising yields, including by means of intercropping.

The gains seen in tests with farmers were substantial. For example,

For crops on terrace walls average yields seen were:

- Yams 6 kg per sack;
- Chayote 350 kg fruit per plant;
- Pumpkin, 52 kg per plant.

For crops grown on terrace edges:

- Rice bean, 430 kg/hectare;
- Horse gram, 320 kg/hectare;
- Cow pea, 290 kg/hectare;
- Black gram, 250 kg/hectare;

For intercrops:

- Maize-cowpea, 26% more than maize alone;
- Millet-soybean, 26% more than millet alone;
- Mustard-pea, 30% more than mustard alone;
- Wheat-pea, 16% more than wheat alone;
- Ginger-maize-soybean, 2% more than ginger alone.

Improved management of farmyard manure also led to higher yields on the plots to which it was applied.

The polythene house and tunnels led to very considerable amounts of tomatoes and other vegetables being produced from the small — typically 50 square metre — gardens enclosed. Some 300 kg of tomatoes had been harvested in a season from 50 square metre poly houses in Kaski.

In most cases where they can do so, agricultural innovations promote farming that both conserves soil and water, as well as working more with ecological processes and local materials, rather than using manufactured fertilisers and chemicals. Examples include:

- Planting along the edges and on the faces of terraces to reduce soil erosion;
- Using intercrops and relay crops to provide soil cover to limit erosion;
- Creation of small ponds to conserve rainfall;

¹³ Households in the rural hills central had an estimated average of NR168,000 a year: at NR74 to the US\$, that was US\$2,270.

- Better management of organic manures from livestock;
- Use of legumes in intercrops to fix nitrogen; and,
- Rhizobia inoculation to increase the fixing by soil nitrogen in soil roots.

Farmers had adopted most of these innovations, with the part exception of rhizobia inoculation: a sophisticated measure that has yet to be confirmed as effective on-farm.

It is difficult to be sure about the full extent of adoption; and even harder to know the impact of such measures. That said, adoption of such practices will almost certainly make farming more compatible with the local environment and minimise environmental damage of soil erosion and degradation and pollution from run-off of agro-chemicals.

3.2.4 Gender

SAK Nepal does not explicitly aim to empower women; but it is programme that works mainly with women farmers. Innovations have been promoted and tested with women farmers in mind: hence the focus of many innovations on saving time and reducing drudgery.

The project has allowed many women farmers to save time, with the corn sheller as the most notable example. For other innovations, small additional incomes, accruing directly to women, have been generated.

But the impact of SAK Nepal on women farmers has been greater than just extra income and time saved. The programme has also helped inter-household relations to become more equal. These improvements come from women being able to contribute to household income from selling their products, from exposure to markets and more mobility in general.

Of course, SAK's contribution to better and more equal gender relations is only one of several drivers. It takes place in a context where aspects of women's lives have changed considerably over three generations — seen, for example, in later ages of marriage for young women, to partners who are of a similar age. Presumably these and other gains to women are owed to more than one driver, and probably not in first instance to agricultural development. Nevertheless, potentially this impact could be as great or greater than anything SAK does for farming. Not only is the growing equality of rural women a major gain, enhancing the lives of half the rural population; but also, it may well lead to economic and social gains, as rural women are able to express themselves fully in all aspects of their lives.

This statement comes with many qualifications: to get closer to proving this with evidence would require months of study. But absence of evidence is not evidence of absence.

3.2.5 Unexpected findings

The main surprise was the extent and way that the programme seemed to help empower women producers, as set out in the previous section. The extent of the self-confidence of the women farmers we met was impressive. SAK Nepal may have made only a small contribution, but it has been a welcome contribution.

3.3 Sustainability and scaling up

3.3.1 Sustainability

Whether the innovations adopted by the farmers at the project sites will be sustained will most probably vary by the improvements in question.

Technical innovations differ by various criteria, as follows, among others:

- The skills and physical capacity needed to use the technique;
- The variability of the task for which the innovation has been developed — for example, shelling maize varies only a little (size of cob, moisture content, etc.), whereas planting crops along the edge of a terrace varies by the type of soil, the slope of the terrace wall, interactions with pests and diseases, the weather during the growing season, etc.;
- Additional costs in money and labour that the innovation requires — for some innovations, there can be immediate savings in cash or labour, others require considerable investment; and,
- The time taken to see the benefit of the innovation, and how easy this is to attribute to the innovation.

For those techniques that are technically simple, requiring skills that are readily learned, where the task does not greatly vary, and where the benefits can be clearly seen at the time of using the technique, innovations once adopted are almost certain to be sustained. Corn shellers and rakes are good example: once accustomed to use a hand-held corn sheller, no-one would willingly go back to shelling by fingers, or thrashing a sack. Even if deep poverty meant someone could not afford the hand sheller, they would probably look to borrow from friends or a group. Indeed, once having seen the gains from a hand-held sheller, users will probably then consider using electric corn shellers in if and when they can afford them, and when the quantity of corn to be shelled justifies the cost.

Innovations that are more costly and complicated are also likely to be sustained, when they show high commercial promise. Plastic houses with drip irrigation are quite costly, and require skills in managing the irrigation, fertilisation and crop protection necessary to raise a crop of tomatoes. The returns are sufficiently great, however, for people to invest, learn the skills and tend the growing crops diligently.

Innovations in crop management, such as intercropping and relay cropping, may be more difficult to sustain because they can present more complicated calculations for farmers, may involve more labour, while delivering benefits that may not be as clear as other innovations — for example, when harvests of different crops in the field take place at separate times, a farmer may lose sight of the total output. While the LIBIRD field staff visit, adopters may feel they have the support to resolve problems, and probably want to impress the field staff with their innovations. That enthusiasm may wane once the project comes to an end and LIBIRD visits become less frequent.

That said, most of the innovations selected and currently being promoted belong to the former two categories and might reasonably — assuming no major changes in circumstances in the short to medium terms — be expected to be sustained. In any case, it was never the intention of SAK Nepal that all farmers would adopt the gamut of innovations: it was always recognised that farmers would select from the menu according to their circumstances and preferences. That implies that as circumstances change through time, so may decisions to use one technology or another.

One reason for optimism arises from the context. The hill farmers operate a varied and indeed complicated farming system: with multiple activities¹⁴ and interactions, above all between crops and livestock. Farmers have worked hard over the years to generate a living from very small farms on steep slopes. The extraordinary terracing of these steep slopes is testament to a rural society not easily daunted by physical challenges — or by hard work.

3.3.2 Scaling up

SAK has two different channels for scaling up. One is the commercial distribution of seeds, tools and equipment

¹⁴ The one 'large-scale' — he had all of one hectare of land — farmer visited had an extraordinary number of farm activities. In crops, he planted cereals, legumes, vegetables and fruit. Livestock consisted of cattle, buffaloes, goats,

that was reviewed in this study. This has had some success. Some seeds and tools are indeed being stocked by agro-vets in rural market centres. Nevertheless, the extent to which this will allow dissemination across the mid-hills of Nepal may be limited, for two reasons.

One is that the coverage of agro-vets who are served by Anamolbiu as distributor is limited: they serve around 50 agro-vets, across the hills and the Terai lowlands. Agro-vets are, moreover, mainly located in market centres on main roads. The combined catchment areas of the agro-vets served by Anamolbiu in the mid-hills are unlikely to extend beyond a small fraction, probably less than a quarter, of the region.

A second reason is that for communities not directly reached by LIBIRD, that is the vast majority of villages in the mid-hills, adoption depends on a combination of agro-vets actively promoting products to their customers, the results of the dissemination of picture books, and word-of-mouth messages from farmer to farmer. That may work for innovations that are quite simple, easy to demonstrate, and have very clear and significant benefits, such as the corn sheller; but may be less effective for more complicated innovations.

Moreover, the existence of grants and subsidies threatens private sector diffusion of innovations. The LIBIRD team have provided seeds, tools and equipment for testing. The District Agricultural Offices also provide similar items either for free, or with a sizeable subsidy. Almost certainly the villagers have received other items from previous development programmes as donations. The danger is that farmers will prefer to wait in the hope that they will be given kit, or be able to buy at a large discount, rather than commit to buying from private companies and dealers. Even one of the most prosperous farmers met planned to buy a mini-tiller only if he could secure the ministry of agriculture grant, expected to be 50%.

SAK Nepal has other measures for diffusion beyond private sector development. The project has documented its proposals and methods. It has done so not only in formal publications, reports and presentations; but has also produced two other, more popular media, more likely to be accessed by farmers. One is a picture book that explains the different techniques. It has been beautifully illustrated and clearly

chickens, bees and doves. I have rarely seen a more diversified farm anywhere in the world.

From just one hectare, the family was generating enough income to escape poverty and live a modestly comfortable rural life.

written. The other is a series, 25 long by late November 2017, of short — 90 seconds to three minutes — YouTube videos. Again, these have been well produced: they make their points well.¹⁵

The challenge for SAK Nepal is to reach the very many other villages spread over the hills of Nepal, many far removed from access to cities or main roads. Picture books can be printed and distributed; it may well be possible to get short videos to other villages — they could be loaded on to a smartphone, for example, or perhaps even broadcast on a TV channel. But just as the material of distance education educates only in part, tutors need to be present to guide farmers, to add explanation, to answer questions and to stimulate interest.

This is not impossible. Nepal has an agricultural extension service. It should be possible to work with them; but we did not ask how much progress, and potential there may be for this. Government extension agents are often under-resourced and already expected to work with farmers on well-defined national and regional programmes. It is not clear that they could take on new work.

In addition to formal methods of extension of innovations, informal dissemination takes place as news of novel ideas spreads through social networks. LIBIRD reports estimates of adopters of SAK technologies among those who have not directly participated in the programme. For practices to raise yields, there were by late 2017 estimated to be just over one additional household adopting the practices for every household that had been reached directly by SAK Nepal. LIBIRD projects that they may more than double the number of adopters of such practices, from the estimated 2,782 to reach just under 6,000 households by 2018.

This would be good, but it's not clear that such processes alone can reach more than a fraction of the hill farmers of Nepal.

The project leader at Guelph has a vision of how to diffuse SAK lessons more widely, both in Nepal and in other countries. He sees that close collaboration with the ministry of agriculture could lead to the widespread use of the picture book to spread messages through the public extension system. More broadly, he favours a strategy of open access and franchising, whereby other agents can use SAK materials, such as the book and short video lessons, for their own programmes. For

physical items, such as tools, he hopes that the details available on the web site may allow entrepreneurs to manufacture them. There may also be ways to spread messages in popular media, given that more than 40% of rural women listened to either the radio or watched television in 2011 (DHS data — for rural men, the number is more, around half of them).

The question for SAK leaders is whether they will be able to find to this the attention it deserves, when CIFSRF funding comes to an end.

¹⁵ Farmers seemingly react well to such videos. In one farmer group discussion, the sales manager of Anamolbiu was answering questions from farmers. To make his point,

he produced his smartphone and showed them a two-minute video. The farmers were enthralled.

References and Appendices

References

- Amacher, Gregory S., William F. Hyde & Keshav R. Kanel, 1996, 'Household fuelwood demand and supply in Nepal's Tarai and mid-hills: choice between cash outlays and labor opportunity', **World Development**, 24 (11), 1725-36
- Blaikie, Piers, John Cameron & David Seddon, 2002, 'Understanding 20 years of change in West-Central Nepal: continuity and change in lives and ideas', **World Development**, 30 (7), 1255-1270
- Metz, John F., 1991, 'A reassessment of the causes and severity of Nepal's environmental crisis', **World Development**, 19 (7), 805-820
- Ministry of Health, Nepal; New ERA; and ICF. 2017. Nepal Demographic and Health Survey 2016. Kathmandu, Nepal: Ministry of Health, Nepal
- MPRC. 2013. VDC and Demographic Profile of Nepal 2013: A socio-economic development database of Nepal. Kathmandu: Mega Publication & Research Centre
- Pradhan, Ajit, Ram Hari Aryal, Gokarna Regmi, Bharat Ban, and Pavalavalli Govindasamy. 1997. Nepal Family Health Survey 1996. Kathmandu, Nepal and Calverton, Maryland: Ministry of Health [Nepal], New ERA, and Macro International Inc.
- Pudasaini, Roshan, Tejendra Chapagain & Manish N. Raizada, 2018, Innovations for Terrace Farmers in Nepal and Testing of Private Sector Scaling Up Using Sustainable Agriculture Kits and Stall-Based Franchises. 42 Month Final Report, 29 April 2018, Pokhara & Guelph, Ontario, Local Initiatives for Biodiversity, Research and Development (LI-BIRD) & University of Guelph
- Thapa, Gopal B. & Karl E. Weber, 1995, 'Status and management of watersheds in the Upper Pokhara Valley, Nepal', **Environmental Management**, 19 (4), 497-513
- Thomas-Slayter, Barbara & Nina Bhatt, 1994, 'Land, livestock, and livelihoods: changing dynamics of gender, caste, and ethnicity in a Nepalese village', **Human Ecology**, 22 (4), 467-94

Appendix A: Itinerary

KII = Key Informant Interview; FGD = Focus Group Discussion

Place	Date [all 2017]	Activity	Respondents	
Kathmandu	Wed 25 Oct	Group Discussion with senior LIBIRD Staff. LIBIRD Office	4	
Pokhara		KII with managing director and marketing lead for Anamolbiu, partner of LIBIRD, Pokhara	2	
Kaski	Thu 26 Oct	KII with field Manager, LIBIRD, Pokhara	1	
Kaski		Interview with LIBIRD Majhthana staff	2	
Kaski		FGD with women project participants, Majhthana. Testing and old intervention site	14	
Kaski		FGD with men project participants, Majhthana. Testing and old intervention site	12	
Kaski		FGD with women project participants, Upallo Saple. New intervention/ scaling up site	15	
Kaski		FGD with men project participants, Upallo Saple. New intervention/ scaling up site	9	
Kaski		Fri 27 Oct	KII with head of Agricultural Division of Lekhnath Municipality, and two of the staff	3
Kaski	Interview with snack food dealer who sells SAK products		1	
Kaski	KII with Chairman of Madi rural municipality, local leader		1	
Kaski	FGD with men non-participants, Thulodhunga		15	
Kaski	FGD with women non-participants, Thulodhunga		12	
Kaski	Interview with staff of co-operative that sells SAK tools and seeds, Sundaridanda		2	
Gogungaura	Sat 28 Oct		Interview with Agro-vet owner selling SAK products	1
Damauli		Interview with Agro-vet owner selling SAK products	1	
Dhumbre		Interview with Agro-vet owner selling SAK products	1	
Dhading		Interview with secretary of local co-operative secretary that sells SAK products	1	
Dhading	Sun 29 Oct	KII. Chairman of Jogimara Rural Municipality	1	
Dhading		FGD with non-participant men, Jeeyamirighat	6	
Dhading		FGD with non-participant women, Jeeyamirighat	22	
Dhading		Interview with Agro-vet shop that sells SAK products, Hugdi	1	
Dhading		Discussion with SAK field staff, Dhading	3	
Dhading		Mon 30 Oct	FGD with participant men, Thimang	7
Dhading			FGD with participant women, Thimang	8
Dhading	Case study of plastic tunnel house and plastic pond, Selangdung		1	
Dhading	Case study of yam in sack farming, woman farmer, Thimang		1	
Dhading	Tue 31 Oct	FGD with participant men, Nepaldanda	13	
Dhading		FGD with participant women, Nepaldanda	8	
Dhading		Observation of Rhizobium test and plastic tunnel house	2	
Dhading		Interview with woman farmer intercropping maize, ginger, peas	1	
Kathmandu	Wed 01 Nov	Interview with Jay Kishan Seed Centre, Teku. Supplier of tools and seeds, including small tools such as fruit picker	2	
Kathmandu		Interview with Nepal China Agriculture Centre, Tripureshwore. Supplier of tools and seeds, including large machinery such as tiller	1	
Kathmandu	Thu 02 Nov	Interview with Soil Microbiologist and Chief Soil Scientist at National Agriculture Research Centre (NARC)	2	
Kathmandu		Interview with S1 officer of Agriculture Engineering Department NARC staff	1	

Kathmandu		Interview with owner and manager of JB Workshop, Gwarko; manufacturer of tools	1
Kathmandu	Mon 06 Nov	Discussion of findings with LIBIRD Staff	4

Appendix B SAK innovations tested

Source: LIBIRD reports

SAK Practices	SAK Products
Selected for scaling up	
Maize-Ginger-Soybean intercropping	Hand-held corn sheller
Millet-Soybean intercropping	Composite vegetable seeds
Mustard-Pea intercropping	Farm Rake
Ricebean as edge crop	Fork weeder
Winter legumes in sequence-Pea	Electric millet thresher
Cattle shed and farmyard manure improvement	Grain/seed storage bags
Drip irrigation and plastic house to grow vegetable	Fruit pickers
Hybrid maize seed production	Hand gloves
Maize-Cowpea intercropping	Silpaulin plastic
Yam on sack as wall crop	Legume seed kits
Pending	
Maize-Bean intercropping	Jab planter (two types)
Pumpkin as wall crop	Mini-tiller
Horsegram as edge crop	Electric corn sheller
Cowpea as edge crop	Maize/Pulses grinder
Seed treatments (5 different treatments)	
Rhizobium trials	
Dropped	
Millet-horsegram intercropping	Table top corn sheller
Millet-Black gram intercropping	Step seeder
Mustard-Lentil intercropping	Hand planter
Wheat-Pea intercropping	Magnifiers for seed sorting (glass and sheets)
Chayote as wall crop	Labels (for local products)
Black gram as edge crop	Low waist brace belt
Winter legumes in sequence-Lentil	Knee and elbow pads
Inverse slope	
Biochar experiments	

Appendix C: Results of intercropping trials

Source: LIBIRD records, with calculations based on recorded field observations.

Season 1: Mid-March to Mid-July: Unit plot size: 30 m² for both test and non-test plots in split plots

Combinations	Location	Intercrop (Test) Plot	Yield (t/ha)			Non-test Plot	Yield (t/ha)	% Increase or Decrease
			Non-legume	Legume	TOTAL			
Maize-makaibodi	Kaski	Biomass	11.98	2.00	13.98	9.93	40.70	
	Dhadin							
Maize-makaibodi	g	Biomass	5.21	4.93	10.14	5.49	84.80	
Maize-suryabodi	Kaski	Biomass	14.21	0.67	14.88	12.44	19.60	
Maize-bean	Kaski	Biomass	12.79	0.89	13.68	12.64	8.20	
Maize-makaibodi	Kaski	Grain	4.10	0.99	5.09	3.40	49.70	
	Dhadin							
Maize-makaibodi	g	Grain	3.97	0.88	4.85	4.06	19.50	
Maize-suryabodi	Kaski	Grain	7.96	0.11	8.06	6.48	24.40	
Maize-bean	Kaski	Grain	6.80	0.10	6.90	7.16	-3.60	

Commodity prices: Maize: Rs. 20/kg, Cowpea: Rs. 90/kg, Bean: Rs. 90/kg (FAOSTAT, 2015)

Income, season 1

Combinations	Location	Intercrop (Test) Plot	Yield (t/ha)			Price non-legume (Rs/ha)	Income non-legume (Rs/ha)	Price legume (Rs)	Income non-legume (Rs/ha)	TOTAL income intercropping (Rs)	Non-test Plot		
			Non-legume	Legume	TOTAL						Yield (t/ha) Non-legume	Income-cropping (Rs)	Increase in income (Rs)
Maize-makaibodi	Kaski	Biomass	11.98	2.00	13.98						9.93		
	Dhadin												
Maize-makaibodi	g	Biomass	5.21	4.93	10.14						5.49	0	
Maize-suryabodi	Kaski	Biomass	14.21	0.67	14.88						12.44	0	
Maize-bean	Kaski	Biomass	12.79	0.89	13.68						12.64		

Maize-makaibodi	Kaski	Grain	4.10	0.99	5.09	50	205000	200	198000	403000	3.4	170000	233000	137%
	Dhadin													
Maize-makaibodi	g	Grain	3.97	0.88	4.85	50	198500	200	176000	374500	4.06	203000	171500	84%
Maize-suryabodi	Kaski	Grain	7.96	0.11	8.06	50	398000	350	38500	436500	6.48	324000	112500	35%
Maize-bean	Kaski	Grain	6.80	0.10	6.90	50	340000	250	25000	365000	7.16	358000	7000	2%

Season 2: Mid-July to Mid-November: Unit plot size: 30 m² for both test and non-test plots in split plots

Combinations			Intercrop (Test) Plot			Non-test Plot		% Increase or Decrease
			Yield (t/ha)			Yield (t/ha)		
			Non-legume	Legume	TOTAL	Non-legume		
Millet-soyabean	Kaski	Biomass	9.12	2.86	11.98	9.02	32.80	
	Dhadin							
Millet-soyabean	g	Biomass	3.88	2.02	5.90	4.36	35.30	
Millet-horsegram	Kaski	Biomass	5.91	0.43	6.34	9.96	-36.40	
	Dhadin							
Millet-horsegram	g	Biomass	6.42	0.37	6.79	5.70	19.10	
Millet-blackgram (Dhading)	Dhadin							
	g	Biomass	4.92	-	4.92	4.82	2.00	
Millet-soyabean	Kaski	Grain	2.96	1.02	3.98	3.03	31.20	
	Dhadin							
Millet-soyabean	g	Grain	3.39	1.15	4.54	3.53	28.60	
Millet-horsegram	Kaski	Grain	3.04	0.33	3.37	3.24	4.00	
	Dhadin							
Millet-horsegram	g	Grain	1.79	0.23	2.02	1.74	16.40	
Millet-blackgram (Dhading)	Dhadin							
	g	Grain	4.53	-	4.53	4.46	1.70	

Income, season 2

Commodity prices: Millet: Rs. 25/kg, Soybean: Rs. 60/kg, Horsegram/Blackgram: Rs. 90/

Combinations			Intercrop (Test) Plot			Non-test Plot		Income from one ha-legume (Rs/ha)	TOTAL income intercropping	Yield (t/ha)	Income-Sole cropping (Rs/ha)	difference in income (Rs)	% Increase or Decrease
			Yield (t/ha)			Yield (t/ha)							
			Non-legume	Legume	TOTAL	Non-legume							
							Price non-legume (Rs)	Income non-legume (Rs/ha)	Price legume (Rs)				

			Non-legume	Legume	TOTAL						Non-legume			
Millet-soyabean	Kaski	Biomass	9.12	2.86	11.98						9.02			
	Dhadin													
Millet-soyabean	g	Biomass	3.88	2.02	5.9						4.36			
Millet-horsegram	Kaski	Biomass	5.91	0.43	6.34						9.96			
	Dhadin													
Millet-horsegram	g	Biomass	6.42	0.37	6.79						5.7			
Millet-blackgram (Dhading)	Dhadin													
	g	Biomass	4.92	0	4.92									
Millet-soyabean	Kaski	Grain	2.96	1.02	3.98	40	118400	200	204000	322400	3.03	121200	201200	166%
	Dhadin													
Millet-soyabean	g	Grain	3.39	1.15	4.54	40	135600	200	230000	365600	3.53	141200	224400	159%
Millet-horsegram	Kaski	Grain	3.04	0.33	3.37	40	121600	200	66000	187600	3.24	129600	58000	45%
	Dhadin													
Millet-horsegram	g	Grain	1.79	0.23	2.02	40	71600	200	46000	117600	1.74	69600	48000	69%
Millet-blackgram (Dhading)	Dhadin													
	g	Grain	4.53	0	4.53	40	181200	185	0	181200	4.46	178400	2800	2%

**Season 1-3: Mid-March to Mid-March: Unit plot size: 30 m² in split plots
Ginger sole crop vs Intercropping System in Kaski**

Combinations	Intercrop (Test) Plot	Yield (t/ha)	Price of Ginger (Rs/kg)	Income ginger (Rs)	Price Intercrop (Rs/Kg)	Income-intercrop (Rs)	Total income intercropping (Rs)	Yield (t/ha)	Income (Rs)	Difference in income (Rs)	% Increase or Decrease	
												Ginger
Ginger-maize		14.05	5.74	60	843,000	50	287,000	1,580,000	20	1,188,000	392,000	33%
Ginger-soybean			2.25	60		200	450,000					

Legumes in rotation, winter 2014

Crops	Grain Yield (kg/ha)	Price (Rs./kg)	Gross Income (Rs)	Cost of Production (Rs)	Net Income (CAD)	Continue? (% Test Farmers)	Saving Seeds? (%)	Ready to Pay (%)	Purpose or End Uses
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Kaski

Pea	3,595.00	105.00	377,475.00	71,000.00	\$3,831	90	30	80	HC
Lentil	1,273.00	142.00	180,766.00	71,000.00	\$1,372	50	40	40	HC
Potato	7,588.00	40.00	303,520.00	81,000.00	\$2,782	100	100	100	HC, Sale
Wheat Dhading	2,318.00	42.00	97,356.00	89,000.00	\$104	40	30	40	HC
			282,300.0						
Pea	3,764.00	75.00	0	71,000.00	\$2,641	100	100	100	HC, Sale
Lentil	2,098.00	140.00	293,720.00	71,000.00	\$2,784	80	50	70	HC, Sale
			225,885.0						
Potato	6,105.00	37.00	0	177,000.00	\$611	100	100	100	HC, Sale
Wheat	2,362.00	31.00	73,222.00	61,000.00	\$153	70	50	70	HC