Cover sheet

Crop diversity and livelihood security in the Andes: the case of potatoes and quinoa

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Abstract

The Andes is beset by low endowments of 'geographic capital' (natural, social, human and physical capital) and chronic poverty is endemic. For over 7000 years, Andean farmers have constantly adapted and selected varieties of quinoa and potatoes in order to reduce their vulnerability to a range of environmental risks and to provide some degree of livelihood security. Data suggest that this strategy is now being undermined. Market pressures associated with globalisation, particularly the requirements for consistency and quantity along with the import of

subsidised wheat products, are displacing traditional crops such as quinoa and many indigenous varieties of potato.

Based on qualitative research in Bolivia, Peru and Ecuador, this paper explores the feasibility of approaches that seek to maintain some degree of crop diversity while simultaneously ensuring that farmers benefit from market opportunities. In the case of potato, the most promising approach is one of 'conservation through use' whereby researchers and development workers seek entry points into the market chain so that it makes commercial sense for farmers to grow local potato varieties rather than improved or more cosmopolitan varieties. Meanwhile, quinoa production and consumption has been enhanced by government-sponsored initiatives which utilise quinoa as part of food support programmes, whilst strengthening production, processing and marketing capability among smallholder producers.

The success of these efforts to reduce poverty and enhance livelihood security depends on the existence an enabling policy environment which supports public and private interventions in remote areas and which encourages extension approaches, such as Farmer Field Schools, in which the emphasis is on active farmer participation and innovation.

Key words: livelihood security, crop diversity, smallholder farmers, Andes, market pressures

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*Crop diversity and livelihood security in the Andes: the case of potatoes and quinoa**

Introduction

The Andes and Chronic poverty

The Andean region falls into three broad ecosystems: the 'Green' Andes stretching from northern Ecuador through Colombia and Venezuela; the 'Yellow' Andes of central Peru and eastern Bolivia; and the 'high climatic risk' Andes of southern Peru and the Bolivian altiplano (Tapia, 1993). Altitudes vary from sea level to over 4500 m and local people's livelihoods, especially in the 'high climatic risk Andes', are threatened by a seasonal variation in climate which can bring drought, floods, frost or hail within one growing season. In the highland areas, livelihood security is further undermined by discrimination, since the arrival of the Spanish Conquistadors, against the indigenous Aymara and Quechua communities.

Some rural areas, such as the Andes, have been characterised as 'spatial poverty traps'. These areas have low endowments of 'geographic capital' (natural, social, human and physical capital) and chronic poverty is often endemic (Bird et al., 2002). Chronic poverty can be defined as occurring when individuals, for a period of five years or more, experience significant capability deprivations in terms of income, expenditure, consumption, assets and nutrition (Hulme and Shepherd, 2003).

Despite these disadvantages, indigenous groups in the Andes, have survived for thousands of years. Much of indigenous people's livelihood security has been based on the consumption of a range of tubers, principally potatoes, and a mix of different grains including quinoa (Dandler and Sage, 1985; National Research Council, 1989). Farmers have adapted and selected different varieties of these crops in order to reduce their vulnerability to a range of environmental risks.

Tubers, grains and livelihood security

The common potato (*Solanum tuberosum* subsp. *tuberosum*) is the fourth most important food crop world-wide. Potatoes, however, originated in the Andes and have been cultivated in the region for over 8000 years. Within Latin America, seven *Solanum* species are recognised, and with thousands of variants throughout the 4000 km long range of the Andes, they form one of the most diverse crops in the world. Seed fairs and local markets have developed over centuries, providing a forum for the exchange and sharing of diverse genetic resources and knowledge. In some Andean communities farmers may be cultivating between 70 and 100 potato varieties and a typical household may be growing 10-12 varieties (Brush, 1991). In addition to potatoes, farmers have also traditionally grown other tubers such as *oca* (*Oxalis tuberosa*), *papalisa* (*Ullucos tuberosus*) and *isaño* (*Tropaeolum tuberosum*).

Quinoa (*Chenopodium quinoa*), known in Spanish as quinua, is an annual plant that grows in the Andean region between sea level and the heights of the Bolivian altiplano, above 4000 m altitude. The grain is small, and can be used as flour, or toasted, added to soups or made into bread. Dried, it can be stored for up to ten years. Quinoa has been cultivated in the Andes for over 7000 years and has long been known and appreciated for its nutritional value. It contains high quality protein, rich in particular amino acids which are scarce in other cereals (Jacobsen, 2002). Quinoa is also a source of a range of vitamins and minerals and has a particularly high iron content (Repo-Carrasco et al., 2001).

Quinoa is a collection of very variable sub-types, which allows the different varieties to survive in an extraordinarily wide range of conditions. Once established, quinoa can survive levels of drought, salinity, hail, wind and frost in which other grains would perish (Risi, 2001). The southern altiplano in Bolivia, for example, is one of the harshest areas to live. Annual precipitation ranges from 110 to 250 mm and temperatures fall well below 0° C for 200 to 250 days per year. Approximately 19,600 families, out of a total of about 25,000 in the region, cultivate quinoa (Laguna, 2000). Farm households in the region rely almost entirely on quinoa production, to the

exclusion of other crops or livestock, and intensively cultivate an average of 6-7 ha per family (Laguna, 2000). Farmers traditionally cultivate three or four varieties of quinoa, which include some with high productivity in good years, and others with high resistance to frost and pests.

Although potato and quinoa diversity has played a vital role in food security and farmers' livelihoods for centuries, and despite the fact that farmers understand the importance of maintaining diversity, researchers and development practitioners are increasingly concerned that farmers now cultivate fewer varieties of both species. The reason for this erosion of diversity, they suggest, is market pressures. These pressures include changing dietary habits, where traditional foods are being substituted by imported foods with lower nutritional values, such as rice and pasta, and also the demands of the market for improved varieties.

Research methodology

The authors sought to determine the extent to which market pressures are undermining the livelihood security of the chronically poor in the Andean region and to explore the feasibility of approaches that seek to maintain some degree of crop diversity while simultaneously ensuring that farmers benefit from market opportunities. Research was carried out in Bolivia, Peru and Ecuador between June and December 2000 and consisted of interviews with non-governmental organisations (NGOs), private companies, international aid organisations and government bodies. Visits were made to farming communities throughout the region, often accompanied by representatives from one of the aforementioned organisations.

Market pressures and declining production and consumption of quinoa and potatoes

Off-farm labour and post-harvest processing

The belief that there is a surplus of labour in rural areas is misplaced. In many parts of the developing world and especially in the Andean region, farmers and their families are increasingly

obliged to work off-farm to supplement farm income, purchase consumer goods and pay for basic health provision (Zimmerer, 1993; Murray, 2001). In the case of Bolivia, farmers temporarily migrate to the cotton, sugar cane, soya and grape harvesting areas in the eastern lowlands of the country and also to Argentina.

Annual migration patterns have had a major impact on cropping patterns. This is especially the case with quinoa where the harvest coincides with off-farm employment opportunities. The harvesting and post-harvest processing of quinoa is labour-intensive. Post-harvest losses may amount to more than 40 per cent of the total harvest, compared to losses of between 10 and 37 per cent for cereals (Risi, 2001). Quinoa grains are bitter, the bitterness is caused by saponins, a group of chemical compounds found in the outer layers of the seed, and which may make up between 0.1 and 5 percent of the grain (Repo-Carrasco et al., 2001). Quinoa needs to be 'de-bittered' before it can be eaten and this is a labour-intensive process.

At the household level, quinoa is washed several times in water, whilst rubbing the grains to remove the outer layers. Poorly dried quinoa increases the incidence of mould and insects; badly threshed grain tends to break and is susceptible to insect attack; poor storage conditions encourage mould, insects and rodents. Field drying leads to considerable contamination from rats. Threshing the quinoa immediately after harvest in the field, and drying it afterwards in a clean location significantly improves quality, but requires facilities. It is difficult to produce consistently good quality, clean quinoa without adequate technology, management and labour inputs. Many farmers are unable or unwilling to accept the forgone income from off-farm work were they to remain in the highlands during the quinoa harvest. This is reflected in quinoa production and consumption figures.

In the 1970s there was a downward trend in quinoa production and by the early 1980s quinoa was a crop in danger of disappearing. For example, it is estimated that in Peru the area cultivated with quinoa per annum fell from 47 000 ha in 1951 to 15 000 ha by the 1970s. In the 1960s quinoa and

another indigenous crop, *kañiwa*, were together the eighth most important crops in Peru but by 1996 quinoa had dropped to thirtieth place (Salas, 2001). Meanwhile, research in three rural communities in northern Ecuador in 1980 demonstrated that in 89 households, only 5 percent of total meals in a 24-hour period contained quinoa (Tripp, 1982). The data obscure the fact that farmers and also urban populations are substituting alternative and cheaper foods for traditional crops such as quinoa and potatoes.

Subsidised wheat and decreasing quinoa and potato consumption

Following the Spanish conquest of the Incas, traditional crops such as quinoa were deliberately repressed and replaced with European species such as wheat, barley and broad beans (National Research Council, 1989), a culinary colonialism that continues to a large extent today. As populations of the Andean countries become increasingly urbanised, the urban poor have tended to move away from consuming quinoa, and purchase products which are easier to prepare and which are of a more consistent quality though less nutritious, such as pasta and rice. The preference for pasta and other wheat products has extended to rural areas. One of the incentives is that these products are cheaper than domestically produced quinoa.

Although the data are confusing, there is evidence that over the past five decades, the increasing imports of subsidised wheat products from North America have displaced traditional crops such as quinoa and potatoes (Hellin and Higman, 2003). Wheat imports to Peru, have risen from 400 000 tonnes in 1961 to about 1.3 million tonnes by 2000 (FAO, 2001) and Peru remains one of the major wheat importers in the world. The scale of the imports dwarf the national production of quinoa, which in Peru in 1999 stood at 28 439 tonnes. Traditional crops such as quinoa are unable to compete against subsidised foods. For example, at 1999 prices a Bolivian farmer who sold 1 kg of quinoa, without the laborious task of removing the saponin, could buy about 1.8 kg of pasta ready to cook (Laguna, 2000).

There has also been a decline in potato consumption. In 1985, Bolivia had the highest annual potato consumption per person in the Americas - 94 kg per person in 1985, compared to Peru at 67 kg per person (Dandler and Sage, 1985). By the mid-1990s, annual consumption in Bolivia had fallen to 54 kg per person while consumption in Peru remained stable (Centro Internacional de la Papa, 1998). Annual consumption in Ecuador is relatively low (32 kg per person), and is exceeded by both Argentina and Chile.

The demand for improved varieties

While total consumption of quinoa and potatoes is falling there is also evidence that crop diversity is being lost. The issue for many farmers is that they are caught between two opposing pressures. On the one hand are the environmental and cultural pressures to maintain a diversity of potato and quinoa varieties for livelihood security. On the other hand, are the pressures to sell to a market that increasingly demands consistency of production, quality and adequate quantities of the same product, a pressure that often drives farmers towards reduced diversity. Potatoes best exemplify this phenomenon.

In urban areas potatoes are increasingly eaten as French fries and these require improved potatoes with a standard quality, quantity and consistency. Hamburger chains like McDonalds import their French fries frozen from the United States and Canada. Other retail outlets use nationally produced improved potatoes as opposed to native varieties. The latter seldom have the right texture and taste for frying, are rarely of the quality necessary for peeling and chopping, and farmers are often not able to provide the quantities required. The problem for development practitioners is that the data are mixed. In some areas diversity is clearly being lost as farmers adapt to particular market demands; in others a combination of production for market and for home consumption may be conserving a wide, though unknown, range of varieties.

There are parts of the Andes, such as the Carchi region in northern Ecuador, where potato diversity has undoubtedly been lost as farmers turn to improved varieties. The first improved varieties were

introduced in the 1960s, replacing low yielding, slower maturing traditional *Andigena* varieties. The newer varieties mature more quickly than traditional ones and allow faster rotations and quicker returns on investment. They also offer higher resistance to pests and diseases. The tens or even hundreds of native varieties which farmers planted only one or two generations ago have now been reduced to a handful (Frolick et al., 2000).

In other areas, however, a different situation is revealed. In the 'Yellow' Andes of Cusco, Peru, 63 per cent of the area sown to potatoes utilizes improved varieties; this drops to 21 per cent in the 'high climatic risk' Andes of Puno around Lake Titicaca (Thiele, 1999). In Bolivia, improved varieties probably comprise less than 20 per cent of the potato crop area. Furthermore in a survey by the Fundación para la Promoción e Investigación de Productos Andinos (PROINPA) in the Colomí region of Bolivia, researchers asked local farmers to do a 'memory inventory' of all the varieties they used in 1953, a marker year when agrarian reform occurred in Bolivia. This list was compared with the varieties currently being planted in the area. In the first year of asking, 80 per cent of the varieties recalled from 1953 were found to be still in use; by the third year of the study, 100 per cent of the varieties had been found.

What is not clear from the data available is whether native potato varieties are grown in the same quantities, or whether varieties that used to be produced in large quantities are now relegated to a corner of a field for occasional home consumption. While the arguments continue as to the extent to which potato (and quinoa) diversity is being lost, development practitioners are investigating mechanisms for ensuring that farmers can benefit from markets while at the same time maintain their crop diversity. Approaches have varied from state-sponsored programmes to establishing links between producers and processors.

Making markets work better

Potatoes: conservation through use

Farmers generally produce four classes of potatoes: mixed native traditional varieties; selected native commercial varieties, improved varieties; and bitter varieties for making *chuño* (Brush, 1991). They need to find a balance between the environmental risks of growing fewer potato varieties and the risk of not supplying the products desired by the market if they choose to cultivate a diverse range of native potato varieties. It is a challenge because a decrease in land availability due to population growth and subdivision of farmland has increased the pressure to intensify production on the remaining portion. Farmers may subsequently reduce fallow periods and turn to more productive, improved potato varieties, supported by chemical inputs of fertilisers and pesticides.

An innovative approach being explored by development practitioners in the Andean region is to modify the market so that it makes commercial sense for farmers to grow local potato varieties rather than improved varieties. In Bolivia, researchers from PROINPA are working with farmers to develop new market niches for a number of tubers grown locally.

One example is to improve the quality, appearance and saleability of freeze-dried potato, known as *chuño*, in order to command a higher price. *Chuño* is produced mainly for home consumption in rural areas and has a limited market in town. Attempts are also being made to increase the market value of *papalisa*. There is a demand in urban areas for *papalisa* but the problem faced by farmers is price fluctuation. In Bolivia in Holy Week the price may rise to US$0.28-0.32/kg but for the rest of the year it falls to about US$0.08/kg. Researchers at PROINPA are investigating the feasibility of drying and slicing the *papalisa*, allowing it to be sold year round through the supermarkets.

Meanwhile, the Papa Andina project, co-ordinated by the Centro Internacional de la Papa (CIP) in Lima, is looking for ways to capitalize on small farmers' knowledge, abilities and the diversity of their potato heritage. A specific focus of the project is to identify the market niches where small

farmers actually have a competitive advantage. The project aims to identify markets where smallholder farmers have a long-term competitive advantage, because of their location, local knowledge, access to local varieties or crop management practices. For example, they suggest that some market niches require small tubers grown at high planting densities and manually harvested, requirements that are much more difficult for mechanised farmers to achieve (Thiele and Devaux, 2002).

The Papa Andina project facilitates contacts between smallholder potato farmers and the processing companies that are becoming increasingly important buyers of potatoes. Farmers learn more about the processors' demands in terms of preferred potato varieties, volumes required, quality and timing of production. The processors, in turn, learn about the varieties of potatoes that farmers grow and how they grow them. With a greater understanding of the reality faced by both parties, the processors can utilise potato varieties that have previously been ignored.

Quinoa: quality, exports and livelihoods

If the national consumption of quinoa is to be increased as well as the potential to export, the issues of quality, processing, image and market access need to be addressed. People know quinoa is good for them: making it accessible and convenient for them, while at the same time providing adequate incomes to farmers is the challenge which has been taken up by a number of organisations working in the Andes.

The Asociación Nacional de Productores de Quinua (ANAPQUI) represents about 5000 of approximately 20 000 quinoa producers in Bolivia. Farmers need to be affiliated to a local association to be part of ANAPQUI, ensuring that they are organised and therefore easier to reach, for both delivery of technical assistance and purchasing. The focus of ANAPQUI's activities is in southern Bolivia where it has a processing plant, allowing it to de-bitter the quinoa and process it into quinoa flakes. The quinoa, almost all organic, is destined in part for the export market.

Demand for organic quinoa is increasing worldwide and it commands an international price some 10-15 per cent higher than conventional quinoa. The high altitude of the Bolivian altiplano means there are relatively few pests and diseases, making quinoa a good choice for organic production; further north, with increasing humidity, mildew becomes a greater problem. In this respect southern Bolivia has a natural competitive advantage over Peru and Ecuador. Many of the farmers who are affiliated to ANAPQUI have qualified for organic certification ensuring that approximately 80 per cent of the association's production is organic.

ANAPQUI's objective is to improve the living conditions of its member producers by paying a fair price for their quinoa. Increasingly, ANAPQUI is looking towards the relatively small but growing export market. In 1997, the export market absorbed only 1.4 per cent of Bolivia's quinoa production, rising to 4 per cent in 1999 and almost 8 per cent in 2000 (Bolivia Times, 2001). The increase is almost exponential and the figures do not include the substantial amount of quinoa that is smuggled out of Bolivia and sold in Peru and Ecuador as nationally produced.

In an attempt to ensure a stable livelihood for their producers, ANAPQUI usually offers a fixed price for the year, based on the previous year's price and an increase for inflation. ANAPQUI offers a link to national and international markets, provides technical assistance to farmers and access to processing. Together ANAPQUI's farmers can produce enough quinoa to market it in quantity, thus meeting one of the key obstacles to securing a niche in export markets. Through its extension network, ANAPQUI can also provide adequate quality control to ensure it meets market requirements.

ANAPQUI, however, sets the price it pays before farmers sow the seed. This leaves ANAPQUI vulnerable to fluctuations in the free market price, caused largely by the size of the harvest. ANAPQUI faced a difficult year in 2000. Average annual quinoa production in Bolivia between 1987 and 1993 was 22 000 tonnes (Bonifacio, 1999). An excellent year for quinoa in 2000 meant that production nationwide of over 40 000 tonnes was expected (Bonifacio, 2000). ANAPQUI

faced a dilemma: the market price dropped sharply due to oversupply. Commercial buyers in the open market were offering about US$0.28/kg of quinoa, a good deal lower than the price ANAPQUI had promised to its participating farmers prior to the harvest. To abandon their producers in a bumper harvest year would be a set-back in building trust and expanding markets, but when even the international fair trade buyers requested a review of the price, ANAPQUI had no choice but to offer farmers less than they had been promised.

ANAPQUI is making a contribution to farmers' livelihood security in the southern Altiplano of Bolivia. In a climate where little else will grow, quinoa provides an unparalleled economic opportunity for many smallholder farmers who have few other options. Quinoa has brought relative prosperity to the farmers who sell quinoa to ANAPQUI. Farmers have expanded their farms and some have mechanised their production. The extra income from increased quinoa sales has allowed children to go to school and farmers to have an unprecedented level of prosperity. The fair price paid to the farmers means that the extra income can be used to increase household food security. However, ANAPQUI's price dilemma also demonstrates some of the difficulties of providing livelihood security based on a single export-oriented crop

Quinoa and national food programmes

Increased quinoa production (and consumption) has also been encouraged by government-supported initiatives. Since 1994, the government of Peru has authorised the national food assistance programme Programa Nacional de Apoyo Alimentaria (PRONAA) to purchase certain agricultural products directly from farmers. Among these products is quinoa, as well as a number of other native Andean grains. Part of the extra incentive to grow quinoa has come from its use in the provision of school breakfasts and for the *Comedores Populares* (popular canteens) run by the government food programme.

Between 1990 and 1995, the school breakfast programme was based largely on imported wheat (approximately 55-65 per cent of the ingredients were wheat-based). The cost was calculated at

approximately US$0.21 per meal. Since 1997, more emphasis has been given to the use of national inputs to the programme, which now account for 70-80 per cent of ingredients: quinoa and other native grains are among these inputs. In 1998, the cost was calculated at US$0.15 per meal and the number of school meals provided rose from 1.45 to 2 million between the period 1990-95 and 1997 (Rivera, 1999).

The state has become one of the main buyers of native crops in Peru, leading to an increase in the area under cultivation. For example, in the 1980s an average of 15 000 ha of quinoa was planted each year; in the last few years, this has risen to approximately 30 000 ha (FAO, 2001). The biggest increase came between 1996 and 2000, when the area planted rose from about 18 000 to 30 000 hectares. In the Puno area, in 1999, 5000 tonnes of food, including quinoa, (as well as other Andean crops including *haba* (broad beans), *chuño* (freeze-dried potatoes), *charque* (dried meat), *kañaheu* (another Andean grain) and *tarwi* (lupin) was purchased from small producers, some of which was distributed to other areas.

The example of PRONAA in Peru demonstrates that production and consumption can be significantly increased as part of a government-sponsored food programme. With a deliberate policy of support to national farmers, a food programme can provide a low-cost, dual function support to food security. On the one hand farmers benefit from a market for their produce and do not have to compete with subsidised imports such as wheat. On the other side, some of the most vulnerable sections of the population – children and women – receive good quality, basic nutrition.

The beneficial impact of a PRONAA-like programme has been recognised by other governments, development workers and some private companies in the Andean region. A new project in Ecuador proposes to follow a similar dual-purpose path. The project aims to improve quinoa production to provide simultaneously an income to poor rural farmers in the Andes, and to improve nutrition through inclusion of quinoa in school breakfasts. The project is seeking to strengthen the production, processing and marketing capability among small producers. The new project, *El*

Proyecto Nacional de Quinoa en Ecuador (Equaquinoa), has the backing of the World Food Programme, along with a number of NGOs, international and national research bodies and private companies.

Chronic poor and rural development

Public and private initiatives and an enabling policy environment

Market pressures are to some extent undermining the livelihood security of the chronically poor in the Andean region by encouraging reduced crop diversity. On the other hand a number of development initiatives have shown that it is possible to maintain some degree of potato and quinoa diversity while simultaneously ensuring that farmers benefit from market opportunities. There is no blueprint for the types of interventions that are needed. The development initiatives outlined in this paper vary from government-sponsored food programmes to private and public organisations that are strengthening production, processing and marketing capability among smallholder farmers.

The case studies outlined above, therefore, strongly support the argument that the neo-liberal market paradigm alone is highly unlikely to lead to type of poverty-reduction and livelihood security envisaged in the Millennium Development Goals (Hume and Shepherd, 2003). On the contrary, the case studies show that there is an urgent need for the type of 'pro-poor growth' and ‘pro-poor markets’ approaches that development organizations are beginning to adopt (Mayoux, 2003). For this to occur an enabling policy environment is needed, one that supports pro-poor public and private sector interventions in remote rural areas, such as the Andes, where many of the chronic poor live.

As part of this enabling policy environment the idea that developing country smallholder agriculture should be given special and differential treatment is being pursued by development NGOs particularly with respect to the World Trade Organization (WTO) Agreement on

Agriculture. The 'Development Box' proposed at the WTO talks in Doha in 2001 would contain a package of measures for developing countries to enable them take account of their development needs by implementing policies to strengthen their domestic production, promote food security and maintain and improve rural livelihoods. The Doha Ministerial Declaration, following the launch of new trade talks in November 2001, agreed that future negotiations should recognise the need for this special and differential treatment for developing countries.

Farmer empowerment

Any initiative designed to strengthen farmers' ability to take advantage of markets while maintaining crop diversity needs to address the question of farmer empowerment (Pretty and Chambers, 1994). The choice of where to go next should belong to Andean smallholder farmers. They need to be able decide which livelihood options best suit their needs. But they also need the resources to enable them to pursue these options. These resources include the self-confidence to negotiate with government, NGOs and processing industry representatives; marketing skills to understand the importance of presentation, quality control and consistency of supply; and the business skills to work together in order to provide the quantities demanded by commercial markets.

External support is essential to assist farmers to learn these skills, to develop market networks, and to gain access to credit and infrastructure. Farmers also need to be empowered to solve their own problems through extension methods that emphasise active participation and innovation. Providing all these skills is a tall order but already Farmer Field Schools (FFS), a training approach for integrated pest management, have been extended to help farmers learn about product requirements and negotiation in these new markets (Braun et al., 2000). Suitably empowered, farmers are better able to influence formal research and extension systems to their own benefit and to gain access to potentially useful skills, information and research products (Hellin and Higman, 2001).

A further extension of the farmer empowerment process may well mean that farmers can continue to maintain the diversity of potatoes and other tubers, while simultaneously benefiting from market opportunities. The FFS approach offers encouraging results. However, it is important to acknowledge that much investment is needed in FFS and the onus is very much on the development community to support this process.

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