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Final report

project

Improving smallholder incomes in the North-western highlands of Vietnam by increasing access and competitiveness in regional temperate fruit markets

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prepared by	Oleg Nicetic, Dinh Thi Huyen Tram, Le Thi Hang Nga
co-authors/ contributors/ collaborators	**UQ associated**: Tiago Wandschneider, Christian Culas and Jenny Margetts. **FAVRI:** Nguyen Quoc Hung, Le Nhu Thinh, Nguyen Thi Tan Loc and Nguyen Minh Chau. **VNUA:** Dr Nguyen Thi Duong Nga, Dr Pham Van Hung, Nguyen Thi Thu Huyen, Tran The Cuong, Ninh Xuan Trung, Tran Van Long and Pham Kieu My. **NOMAFSI** Lưu Ngọc Quyến, Phạm Thị Sến, Nguyễn Duy Phượng, Vũ Hoàng Lâm. **CASRAD:** Dao The Anh, Bui Quang Duan. **PPRI:** Pham Thi Vuong, Nguyen Nam Hai and Nguyen Van Chi. **Lao Cai DARD-Crop and Plant Protection Division**: Nguyen Van Hung and Pham Quoc Cuong, Bui Quy Dien.
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Contents

1 Acknowledgements

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2 Executive summary

Introduction

The project was developed and implemented with support and co-funding from the Vietnamese Ministry of Agriculture and Development (MARD) and received a high level of interest and support from the Son La provincial and Moc Chau district governments. Co-funding and local government involvement in project development resulted in an equal emphasis on research and development. The research component was related to understanding temperate fruit market dynamics, including current supply, demand, consumer preferences and price fluctuations in local, provincial, national and broader regional markets; and the barriers for farmers' adoption of the cultivation techniques developed under previous projects and the varieties introduced in the past. The initial research results and market intelligence were communicated "in real-time" to government institutions, private sector stakeholders and farmers and were used in government planning and policy decisions and by traders and farmers to develop and expand domestic and export markets. This dynamic interaction between the project team and stakeholders resulted in significant modification of research and development activities presented in the project document at the time of approval. These modifications reallocated the project resources to activities requested by the local development actors.

Aim

To improve net income and livelihoods of ethnic minority households in NW provinces of Vietnam by increasing access to and competitiveness in Asian temperate fruit markets through more strategic market-driven industry planning and development.

The project focused on plum, peach, persimmon (astringent and non-astringent) and Asiatic pear.

Objectives

1. Evaluate consumer and market dynamics and opportunities at the local, provincial, national and regional levels.

2. Support government-led planning, coordination and development of the temperate fruit industry across Son La, Lai Chau and Lao Cai.

3. Overcome barriers to adoption of improved varieties and cultivation techniques currently constraining the development of the temperate fruit industry in NW Vietnam.

4. Develop competitive consumer-driven marketing and value chain models for engagement with more profitable markets

Research approach

The approach the project took was a) holistic market research where entire production and marketing systems were analysed (not just niche markets as in previous projects), and the attractiveness of various market segments was assessed, taking into account environmental suitability for fruit production and farmers capacity to learn new skills and invest in production; b) the focus was not on smallholders alone but equally on agribusiness companies with sufficient funds to invest in advanced production and postharvest technologies; c) the development of novel communication platforms and processes to stimulate private-public partnerships and communicate market intelligence in real-time enabling the government and private sectors to make decisions based on market signals; d) use of anthropological methods to understand the attractiveness of new technologies in fruit production and institutional finance products (e.g. Loans) to local people, Kinh and ethnic minorities (mainly Hmong), not through the perspective of Western economically biased man (*Homo economicus)* but using complex local cultural value systems and specific needs arising from obligations towards neighbours, clans and ancestral spirits.

Major research findings

Development of market-driven temperate fruit industry

GIS mapping (See Map 1&2) showed that large areas in Moc Chau (Son La) and Lai Chau provinces are suitable for producing low chill temperate fruits with chill units of 250 and below. There are also several areas where fruit varieties with 250-600 CU requirements can be grown, but most of these areas are very remote, and investment in infrastructure, including access roads, is needed before starting production of medium to high chill fruits. Even though a GIS map was not produced for Lao Cai province, data available at the provincial DARD level was sufficient to determine the situation in Lao Cai was similar to Son La and Lai Chau. Considering these natural conditions and market demand, low chill peaches and nectarines, early plums, Asian pear and avocado have great potential to be profitably grown, reduce regional dependence on maize production and improve soil erosion management. Non-astringent persimmon varieties also have good market potential and could be recommended if technical solutions are found for current problems in nursery production.

Son La province has developed a large and still expanding plum industry mainly due to its competitive advantage in having a Tam Hoa plum variety preferred by Vietnamese and Chinese consumers harvested two to three weeks earlier than in competing Lao Cai province and China. The Son La provincial government also stimulated the development, as a part of its efforts to diversify from the dominant maize production, by providing free, good quality planting material and technical support. The competitive advantage and stimulative policies resulted in 10,000 ha under plum production, making Son La by far the largest producer, with Lao Cai with 800 ha coming second. However, the latest massive expansion in Tam Hoa’s growing areas that more than tripled between 2015 and 2019, was mainly driven by positive market signals with farmers starting new orchards using their own marcotted planting material or buying grafted seedlings from private nurseries and not through the government providing free planting materials.

Unfortunately, our market analysis showed that plum over-supply is inevitable. In 2016, when the expansion in new planting areas began, the supply was well-matched with demand. The market value could grow by improving fruit quality, but there was limited potential for growth of supply volume. Two market segments, the Chinese market for processing quality plums and the Hanoi market for average quality fruit, accounted for 70% of market volume and were at their peak, while the Chinese processing market will most likely decline and the Hanoi market remain stable.

Most growth potential exists in Chinese fresh fruit markets for high-quality plums to capitalise on Son La's competitive advantage of earlier harvest compared to China, but there is a considerable risk in developing this market due to trade regulation uncertainties related to export to China (The current export is unofficial see 7.4.2 and Fig 22). Another opportunity is to grow markets in Ho Chi Minh City and Central Vietnam, but even if this market segment (2,000 t in 2016) doubles its volume, the increase will account for only a small fraction of increased plum volume from the recent production expansion.

The predicted oversupply will cause a significant price drop in the early 2020s, which may stimulate increased consumption in urban areas and eventually stabilise prices, but many growers producing low-quality fruit could be forced out of the market. The Son La government and other donors should evaluate the development of the fruit processing industry to capture opportunities from abundant, cheap, locally produced plums. On the positive side, larger growers producing high-quality plums in prime areas, including communes of Pak Hem, Ban On, Cu Do, are most likely to continue developing viable plum industry, supplying urban markets and contributing to the development of agritourism in Son La province.

The temperate fruit industry in Lao Cai is much smaller but more diverse, with nearly equal production areas of plum, pear and peach. However, development is still based on a very limited number of varieties of each species, with the provincial government directing most

of the resources into the development of VH6 pear production. Our market research showed that a planned increase in VH6 production to 4,500 t by 2025, harvested in early summer (June and early July), would compete with 3,000 t imported from China currently sold in the Long Bien market at the same time of the year at the low price below 20,000 VND. Lao Cai farmers cannot compete with Chinese imports on price, so they have to use their competitive advantages, mainly a strong preference of Vietnamese consumers for domestically produced pears that are on par with Korean and Japanese imported pears sold, putting Lao Cai pear producers in a position to sell a good quality VH6 pears for 30-40,000 VND/kg, approximately half of the price for Korean pears and double the price of low-quality "Chinese yellow" pear. Other potential competitive advantages include seasonality and vicinity to the neighbouring Chinese province of Yunnan, opening export opportunities. VH6 pear can be harvested two to three weeks before pears grown in China's pear production centre in Hebei, more than 2,000 km away from Yunnan.

Therefore, a shift in government strategy away from the subsidised expansion of planted areas based on a single variety with a short harvesting season is necessary to develop a sustainable industry. The local government working closely with the private sector should focus on key sources of competitiveness of their regions compared to other fruit production regions in Vietnam and China. The proximity of China is a source of competition in the domestic market, but equally, it gives export opportunities that should be well understood before developing any strategic development plans. The development of nurseries with diversified portfolios of productive and marketable varieties should be prioritised. Earlier varieties should be favoured to capture export opportunities and shield farmers from import competition. Research institutions in cooperation with the extension services should develop technologies specific to the targeted markets, e.g. in areas producing mainly plums for processing orchards can be redesigned to increase planting density and crop load and increase efficiency and profitability of production. The coordinated effort of government extension services and input providers would improve critical technical know-how to farmers to increase the proportion of good-quality fruit that meets consumer preferences in Vietnam and China. The establishment of the temperate fruit industry associations in each province, comprising leading farmers, cooperatives, traders and processors, could be an important step towards the stronger influence of private industry and market signals on government planning, policies and allocation of resources.

Hanoi temperate fruit market

Hanoi temperate fruit market has been dominated by fruit imported from China. In the major Hanoi wholesale market, Long Bien, between 2015 to 2017, 66-86% of plums, 65-78% persimmons and nearly all peaches and pears traded were imported from China. At the same time, the market share of Vietnamese plums grew from 14 to 34% and persimmons from 22 to 35%. Data show that importers very skillfully regulated the supply volume from China so that traded volumes and prices were not negatively correlated, i.e. in months when sale volume peaked, the prices were also highest. In contrast, the relationship between sale volumes and prices is negatively correlated for Vietnamese fruit, with a dramatic reduction in prices recorded during peak plum season. There is a significant variation in quantities and varieties of fruits imported from China from year to year, indicating that imports from China are not part of any marketing strategy, but Chinese traders offer varieties of fruits when there is a surplus in Chinese markets. Finally, data indicated that Vietnamese fruits positioned themselves between cheap Chinese and expensive Korean and Western countries imports.

The modern fruit retail segment is very heterogeneous. Retailers differed considerably in terms of size, marketing strategy and sales performance. Suppliers in production areas will need to develop differentiated product and pricing strategies to meet retailer requirements and maximize the benefits to farmers and their own businesses.

The safe-food retail segment is particularly small and fragmented. However, businesses in this segment are innovative and willing to sell fruit with a high price and low volume, making them suitable partners for introducing new fruit varieties into the market. As demonstrated

for the newly developed Lao Cai VH6 pear, the segment can effectively promote the new product and its origin through various channels, especially social media. Cooperation with this segment should also be considered for developing a regional branding for a range of products.

The sale of Tam Hoa plums from Son La to modern retailers more than doubled from 2016 to 2017 but still represented less than 1% of total plum sales. While direct income from this segment will remain relatively modest over the foreseeable future, there is much scope for growth, and other impacts should also be considered. The presence of Vietnamese plums in modern retail outlets have changed the perception of local plums as a low-status fruit, leading to increased consumer demand. The status of plums has also been assisted by strong tourist promotion, whereby plum orchards together with tea gardens represent a major attraction in Moc Chau. In 2017 the plum harvest festival attracted more than 7,000 visitors to the district and received high media coverage.

The growing involvement of modern retailers should also result in a more enabling technical- and quality-upgrading environment. This could have spillover effects on plum farmers supplying traditional market segments, while quality assurance systems or product branding strategies developed for plums may be applied to other smallholder farm products.

Barriers to adoption of technical innovation by smallholder farmers

The main barriers to the adoption of improved production practices are related to the following factors (i) lack of consultation with local stakeholders during the design phase of the project, (ii) lack of participatory approaches to facilitate the involvement of stakeholders, especially the local authority, extension officers and farmers in project implementation, (iii) inappropriate communication strategies, (iv) poor linkages to local government initiatives and lack of follow-up activities after project completion, (v) inappropriateness of techniques in the local context and high cost for their adoption, and (vi) poor and unstable supply chains.

The review of project-related documents targeting ethnic minorities exposes a common lack of attention paid by project teams to the local development context and history of targeted ethnic communities. Projects seldom consider the way beneficiaries think about development and how they would like to achieve it. There is a pluralism of interests in communities because not all individuals have the same plans or wishes for their future and related development, but instead of listening to community voices, project teams often push their development vision on communities.

To overcome these barriers, research priorities should be based on strategic plans for the temperate fruit industry development on national and provincial levels. The design of research projects should be a consultative process involving a broad range of industry stakeholders and should be aligned with local government priorities. Monitoring and evaluation of project implementation should be a participatory process involving local institutions, the private sector and farmers. Development of support mechanisms for the adoption of new technologies should be part of the project itself, or it can be a separate activity but should be coordinated with the project implementation. When projects involve ethnic minorities, then attention has to be paid to the nuanced local social networks and local power relations, and project implementation needs to be adaptive to embrace farmers' realities in different locations and transform the project focus and activities to suit beneficiaries own needs and capacities.

The study on the influence of ethnic minority beliefs on adopting new technologies, especially pruning, confirmed the strong animist beliefs of Hmong and Dao farming families. They believe that objects, places and living creatures all possess a distinct spiritual essence. However, both groups reported their beliefs didn't explicitly determine how to manage their plum orchards because they see plums as "foreign". Farmers were often reluctant to conduct invasive techniques such as pruning, canopy training or fruit thinning because they see trees as living spiritual beings, but also they were not convinced of the financial benefits.

The study on access to finance concluded that most farmers have access to institutional and private landers loans, but because farmers often require frequent, small loans, with flexible repayment terms aligned to highly uneven seasonal cash flow and crop calendars, taking loans from private lenders is more common. Farmers' hesitance to use a land title as collateral and the complexity of financial institutions approval processes are other major factors for farmers preference for private loans despite higher interest rates. To overcome these barriers, many institutional lenders have their agents in communities. The agents are eighter trusted individuals like village leaders or mass organisations, including Woman or Farmer Union. Institutional lenders should diversify their portfolios to include microfinance products without collateral, even if that means increasing interest rates if they want to serve more small farmers.

The main barriers to introducing new varieties are an undeveloped nursery industry that suffers from a lack of autonomy from government institutions, over-reliance on projects, a lack of entrepreneurship and international contacts, and inability to collect royalties resulting in limited access to new varieties.

Results show that the main barriers to adoption of improved production practices is related to the following factors (i) lack of consultation with local stakeholders during the design phase of the project, (ii) lack of participatory approaches to facilitate involvement of stakeholders, especially the local authority, extension officers and farmers in project implementation, (iii) inappropriate communication strategies, (iv) poor linkages to local government initiatives and lack of follow-up activities after project completion, (v) inappropriateness of techniques in the local context and high cost for their adoption, and (vi) poor and unstable supply chains.

The main barriers to introduction of new varieties is an undeveloped nursery industry that suffers from lack of autonomy from government institutions, over-reliance on projects, a lack of entrepreneurship and international contacts and inability to collect royalties resulting in limited access to new varieties.

The lack of participation of local stakeholders including government institutions, farmers, input suppliers and traders in project formulation and implementation is the main underlying cause of poor adoption of project outputs. Because research institutions work in isolation, project teams usually make improper selection of sites and/or households, improper identification of priorities, improper planning and implementation of activities and finally the technologies developed are unsuitable for the local socio-economic and/or environmental context. After project completion the local institutions, who were not involved in the project implementation, do not have the necessary human and financial resources to support adoption of project outputs through necessary technical training of farmers or building farmer capacity to access finance to enable the implementation of new technologies. Lack of capital is often the main barrier hindering farmer adoption, even when they understand well and know how to apply new practices.

To overcome these barriers, research priorities should be based on strategic plans for the temperate fruit industry development on national and provincial levels. Design of research projects should be a consultative process involving a broad range of industry stakeholders and should be aligned with local government priorities. Monitoring and evaluation of project implementation should be a participatory process involving local institutions, the private sector and farmers. Development of support mechanisms for adoption of new technologies should be part of the project itself or it can be a separate activity but should be coordinated with the project implementation. To facilitate these processes, project AGB/2012/060 is developing provincial and interprovincial forums as the platform for dialog between all stakeholders involved in TF industry and is currently working with the provincial government of Son La and Lao Cai provinces on development of strategic plans for TF industry development based on potential supply capacity and market demand. Strategic plans will also identify research priorities and capacity building needs of local government institutions, private sector stakeholders and farmers.Enter text (this text will be published on the ACIAR website)

Learnings from development activities

The major constraint identified impacting temperate fruit industry development is the lack of coordination between different stakeholders in the private sector (seedling producers, growers, traders, retailers and processors) and between the private sector and local government. This has been resulting in top-down government-led sector planning with little basis on market information. Another limiting factor is the under-developed nursery industry, which still lacks access to modern varieties (due to the inability to conform to international standards on variety protection) and thus still heavily relies on a few varieties with short harvest time.

The project initiated the formation of a Temperate Fruit Industry Association by establishing a working group in May 2018 to develop the 'pilot' Temperate Fruit Association in Son La province to address the above main issues. The main objective of the Association as drafted by the working group is to (1) facilitate collaboration between different stakeholders in the industry, (2) represent its members to liaise with the government and inform the planning and policymaking processes, and (3) promote RD&E and especially the introduction of new varieties. The Association will further develop the initial Strategic Plan for temperate fruit development drafted by the project.

Future external support is needed for developing Association's organisation and management structures, communication mechanisms, and information management systems required for an industry association to function efficiently and benefit its stakeholders. Building core leadership and governance capacity and advocacy skills for association members are also necessary.

Further research is needed to evaluate options to enhance temperate fruit nursery production and variety management capacity and improve access to improved varieties outside Vietnam. MARD has facilities to access PBR varieties and legal framework for their protection in Vietnam, but DARDs and nurseries on the provincial level lack the capacity to comply with the legal and commercial IP protection requirements. Further investment should be directed to the Son La Temperate Fruit Industry Association to develop sustainable variety protection and royalty collection mechanism to conform with international standards and thus get access to modern protected varieties.

Further research and feasibility studies into processing opportunities are recommended to address the oversupply of plums and identify opportunities for fruit production targeting processing and meeting processing industry requirements.

Provincial and interprovincial forums were effective platforms to initiate system-wide change within provinces. The key to successful forums was a long consultative process with the participants leading up to the forum and follow up activities with participants to assure decisions made at the forums were implemented. Future forums should be planned as short events, typically one day, with the first part focusing on high-level officials (usually one morning followed with lunch) where summaries of major findings are presented with clear implications for government policies and investments and the follow-up (usually in the afternoon or next day) where the plan of activities are developed with government institutional staff, based on directives from the high-level officials attending the previous session. A forum can also be an effective platform to mobilise private sector actors for development activities. It is recommended that the forum format be trialled for dialogue between provincial and central level institutions.

3 Background

The project was developed and implemented with support and co-funding from the Vietnamese Ministry of Agriculture and Development (MARD) and received a high level of interest and support from the Son La provincial and Moc Chau district governments. Co-funding and local government involvement in project development resulted in an equal emphasis on research and development. The research component was related to understanding temperate fruit market dynamics, including current supply, demand, consumer preferences and price fluctuations in local, provincial, national and broader regional markets; and the barriers for farmers' adoption of the cultivation techniques developed under previous projects and the varieties introduced in the past. The initial research results and market intelligence were communicated "in real-time" to government institutions, private sector stakeholders and farmers and were used in government planning and policy decisions and by traders and farmers to develop and expand domestic and export markets. This dynamic interaction between the project team and stakeholders resulted in significant modification of research and development activities presented in the project document at the time of approval. These modifications reallocated the project resources to activities requested by the local development actors.

3.1 The rationale for the project

The North West is the poorest region in Vietnam, with Lai Chau, Son La and Lao Cai provinces ranking 1st, 3rd and 4th in terms of poverty rates. At the time the project was developed, 40-60% of the population in these provinces lived below the official poverty line of VND 400,000/month/person (GSO, 2010), which was far higher than the national poverty rate of 11% (World Bank, 2012). The Vietnamese government invested considerable effort and resources, especially during the 1990s, to develop temperate fruit production in the NW highlands. The objectives of this government intervention were very sound and included a) diversified and intensified agricultural production to increase farmers' income and reduce poverty, b) provision of additional food sources and contribute to the food security of local people, c) increased permanent settlement of minority groups that still live a semi-nomadic lifestyle, d) create opportunities for market engagement, and e) protect the environment and water resources. During the project's implementation, it became apparent that another reason for introducing plum production was to replace the cultivation of opium poppies, which the government banned in the early 1990s.

Government investment in the new plantings was well supported by local People's Committees, leading to a significant expansion of Tam Hoa plum production areas, which peaked in the early 2000s. The production has contracted in the mid-2000s due to falling prices following a major increase in Tam Hoa plum supply and increased availability of other competing fruits from Vietnam and China in urban markets. This experience illustrates the critical need for fruit industry development plans to include a range of fruit species and varieties, and interventions to be aligned with market size and demand patterns. However, unfortunately, the national government and international donors' efforts over the past two decades to introduce new plum, persimmon and peach varieties and improve the quality of fruits in production have had limited success.

In 2012 when this project was developed, MARD still saw growing temperate fruits as one of the major opportunities for poverty alleviation among ethnic minorities in NW Vietnam, but after decades of investments with limited success, stipulated that a new approach was needed (Dr Doanh, Vice Minister for Agriculture, personal communication). This need for a new approach and belief that the Vietnamese-Australian transdisciplinary research team, which had successfully completed ACIAR project AGB/2008/002 could formulate and deliver the new project with the "new approach" in partnership with the provincial

governments of Son La, Lao Cai and Lai Chau was the main rationale to fund yet another (seventh) ACIAR project related to temperate fruit in Vietnam.

The new approach the project took was a) holistic market research where entire production and marketing systems were analysed (not just niche markets as in previous projects), and the attractiveness of various market segments was assessed, taking into account environmental suitability for fruit production and farmers capacity to learn new skills and invest in production; b) the focus was not on smallholders alone but equally on agribusiness companies with sufficient funds to invest in advanced production and postharvest technologies; c) the development of novel communication platforms and processes to stimulate private-public partnerships and communicate market intelligence in real-time enabling the government and private sectors to make decisions based on market signals; d) use of anthropological methods to understand the attractiveness of new technologies in fruit production and institutional finance products (e.g. Loans) to local people, Kinh and ethnic minorities (mainly Hmong), not through the perspective of Western economically biased man (*Homo economicus)* but using complex local cultural value systems and specific needs arising from obligations towards neighbours, clans and ancestral spirits.

The project was also mandated to utilise findings and technologies developed in the previous ACIAR projects PN 2127 “Adaptation of low-chill temperate fruits to Australia, Thailand, Laos and Vietnam”, CS1/2001/027 “Adaptation of low chill stone fruit to Australia, Thailand, Laos and Vietnam”, AGB/2002/086 “Improving the postharvest quality of temperate fruits in Vietnam and Australia”, AGB/2006/112 “Improving the postharvest quality of temperate fruits in Vietnam and Australia”, AGB/ 2006/066 “Improving productivity and fruit quality of sweet persimmon in Vietnam and Australia” and AGB/2008/002 “Improved market engagement for sustainable upland production systems in the North West Highlands of Vietnam” in the development of the strategic plan for the temperate fruit industry in Son La and Lao Cai provinces.

Finally, the project aimed to address the agreed priorities identified during ACIAR’s north-western highlands consultations in September 2008 (ACIAR Operational Plan, 2012-13):

a) P*overty reduction through market engagement for smallholder farmers in the northern and north-western highlands (provincial focus: Son La, Dien Bien, Yen Bai, Lai Chau and Lao Cai)*
b) *Better integration of smallholder farmers into profitable markets for high-value crops and agroforestry through market and supply chain analyses with a focus on fruits and vegetables*

3.2 The research team and project management

The project was implemented by an interdisciplinary inter-institutional Vietnamese team supported by international researchers from Australia, Portugal and France. The Fruit and Vegetable Research Institute (FAVRI) was the lead organisation that coordinated activities between research institutions, and between research partners and provincial and local governments. FAVRI led postharvest and pomological research and contributed to market and consumer research. Vietnamese National University of Agriculture (VNUA) was the major contributor to market research, and the Centre for Agrarian Systems Research and Development (CASRAD) led value chain research and development activities. The Plant Protection Research Institute (PPRI) led activities in Lai Chau province and researched technical issues, including thinning plum fruit and pear production. The Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI) was in charge of research related to the barriers to adopting new technologies and supporting the development of fruit production in Lai Chau province.

Mr Tiago Wandschneider supported the mixed FAVRI-VNUA-CASRAD team in the development and implementation of market and consumer research, as well as the value chains research and development. Tiago worked closely with Dr Nguyen Thi Duong Nga from VNUA and Dr Nguyen Thi Tan Loc from FAVRI (Objectives 1 & 4).

Dr Suzie Newman was in charge of postharvest research that supported value chain development. The main activity of the postharvest team was auditing plum quality in wholesale markets and retail outlets. Dr Newman also was in charge of the organisation of the first interprovincial forum. Ms Jenny Margetts replaced Dr Newman in 2017 and was in charge of the participatory development of the strategic plan. Ms Margetts organised a visit of the Son La province delegation to Australia. She was pivotal in connecting Son La private sector actors with the Australian nursery association ANFIC, resulting in commercial contracts and new peach varieties to Son La province (Objective 2).

Dr Cristian Culas from Marseille University and Ms Le Thi Hang Nga conducted anthropological research on the influence of Hmong beliefs on participation in projects, adoption of new technologies and access to finance. Their work was complemented by the comparative case study on the implementation and impacts of several national and international projects on temperate fruit in NW Vietnam led by Dr Pham Thi Sen. Dr Le Thi Hoa Sen from the Hue University of Agriculture and Forestry conducted a review of the extension material related to temperate fruit production (Objective 3).

Dr Oleg Nicetic from the University of Queensland and Dr Nguyen Quoc Hung led the project, and Ms Dinh Thi Huyen Tram coordinated all activities, provided translation and information management. The management structure is shown in Figure 1.

Two key approaches to team formation and management positively contributed to the research outcomes. The first was the interdisciplinary composition of the activity teams that consisted of agricultural technical experts, economics and agribusiness experts often supported by a team member with social science and agricultural extension knowledge and skills. In this way, for all research activities, activity teams collected data using various quantitative and qualitative methods and analysed data from different disciplinary perspectives. Further, any project development interventions were implemented, taking into account technical and socio-economic feasibility. The other positive effect of the mixed team was the close relationship between researchers from different institutions who spent lots of time together travelling and doing fieldwork. The researchers also broadened their knowledge about other disciplines related to agriculture and rural development.

The second approach was the appointment of a full-time independent project coordinator, which was pivotal to facilitating the formation and function of inter-institutional inter-disciplinary teams, translation and management of research data, interim reports and sharing of information in real-time. Information from all teams was accessible to everyone, regardless of the institution they belonged to, via a file storage cloud. The coordinator was

also in frequent contact with local government institutions resulting in coordinated actions between the project research activities and government planning and implementation of activities by the government institutions. It is unlikely that would have been achieved if the coordinator was not a full-time Australian commissioned organisation (UQ) employee.

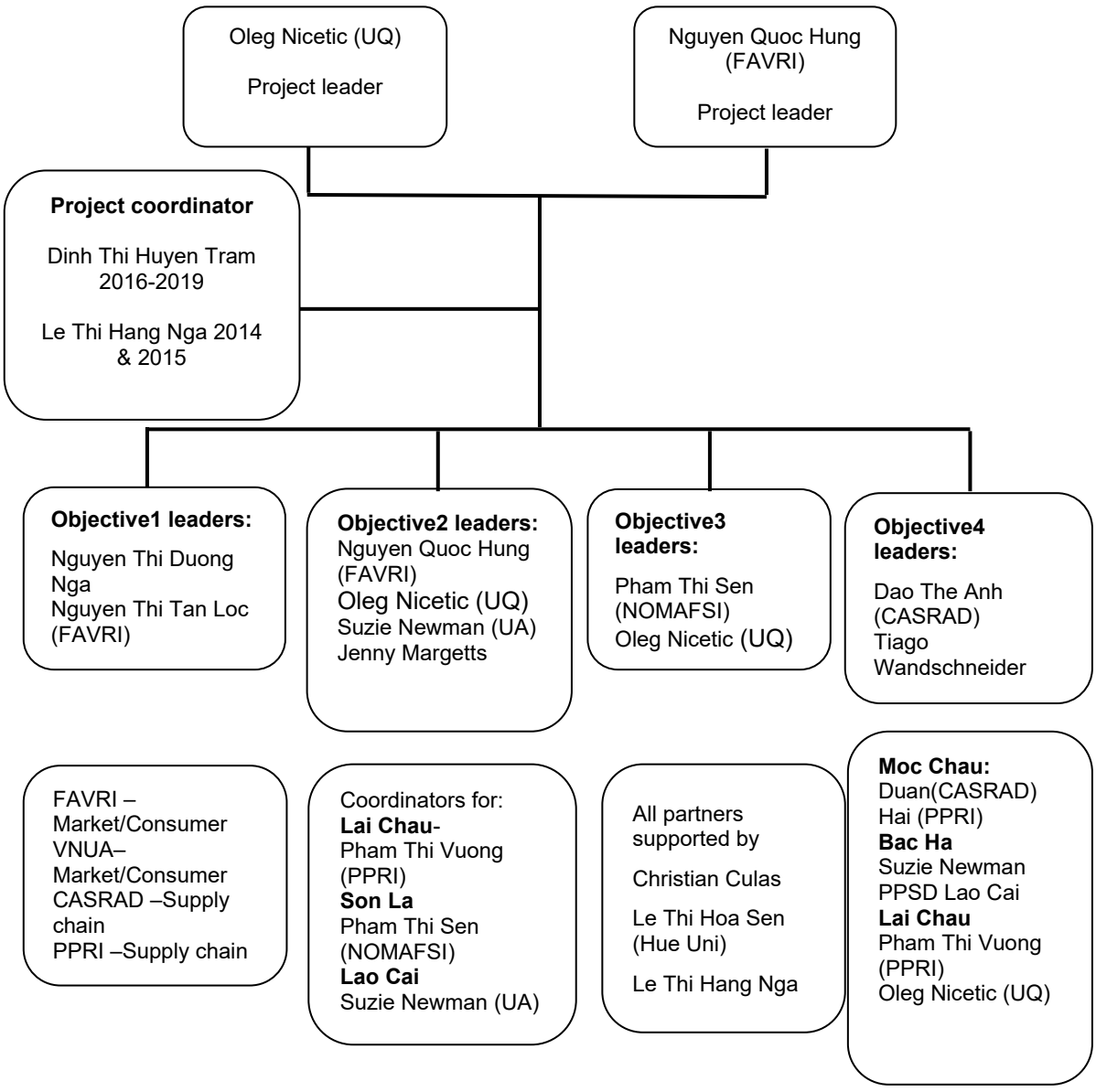


Figure 1: The project management structure

4 Objectives

Aim

To improve net income and livelihoods of ethnic minority households in NW provinces of Vietnam by increasing access to and competitiveness in Asian temperate fruit markets through more strategic market-driven industry planning and development.

The project will focus on plum, peach, persimmon (astringent and non-astringent) and Asiatic pear.

Objectives

1. Evaluate consumer and market dynamics and opportunities at the local, provincial, national and regional levels.

2. Support government-led planning, coordination and development of the temperate fruit industry across Son La, Lai Chau and Lao Cai.

3. Overcome barriers to adoption of improved varieties and cultivation techniques currently constraining the development of the temperate fruit industry in NW Vietnam.

4. Develop competitive consumer-driven marketing and value chain models for engagement with more profitable markets

Research Questions

The market and consumer research sought to answer the following research questions:

What are the temperate fruit varietal and quality preferences of different consumer segments in Vietnam's major urban markets?

What are the market conditions for selected temperate fruits, including plum, peach, persimmon and Asiatic pear?

What are strategic production choices (species, cultivation technologies, locations, and planting areas) likely to deliver high returns and acceptable investment and risk levels to large numbers of smallholder growers in the Northwest?

The research in government-led industry development evaluated planning, coordination, and facilitation processes leading to the engagement of the public and private sectors in developing the temperate fruit industry in the Northwest. Specific questions included:

Are provincial and inter-provincial forums effective in facilitating government-led temperate fruit industry development in the Vietnamese political and social context?

Which facilitation and learning methods are most appropriate for utilisation at the forums.

Research to identify barriers to adoption of introduced improved varieties and cultivation techniques developed in previous international and national projects focused on answering the following questions:

What are the specific factors within the farmers' socio-economic and cultural background and the national and local political and economic environment that influence adoption?

What perceptions and beliefs of ethnic minority groups concerning fruit and forest trees and their utilisation could directly influence adoption and innovation in temperate fruit production?

What are ethnic minority farmers' perceptions of and attitudes towards government-run projects and engagement with financial institutions and markets?

Research into the development of competitive consumer-driven marketing models saught to answer the following questions:

Would smallholders benefit more by value chain development interventions targeting the high-value market segment or by a simpler intervention that optimises existing supply chains to traditional markets?

What is the spill-over effect of the value chain development that focuses on niche markets involving a small number of farmers in the wider farming community?

5 Methodology

The project team utilised a combination of quantitative and qualitative methods. Quantitative methods included surveys, long term recording of products volumes and prices in wholesale markets and retail outlets, auditing product quality; qualitative methods included key informant interviews, focus group discussions, storytelling and analysis, and mapping value chains. The methods used for specific research activities, including market and consumer research, value chain analysis, farm production surveys, case study analysis, enquiry into the ethnic minorities culture and beliefs, are presented together with the results of the research activities for which the methods were used. In this section, only the overall research approach is presented.

5.1 Research approach

The research process was guided by the Agricultural Research for Development (AR4D) framework initially developed in project AGB/2008/002 and adapted for the current project (Fig 2). Diagnostic research was at the heart of the project, continuously analysing data and information collected in various research activities throughout the project, not just in the project's initial phase, allowing the project team to adjust methods and allocate resources to maximise the project's impacts. Diagnostic research was operationalised as continuous participatory monitoring and evaluation (PME) of all project activities. The PME involved representatives from provincial and district government institutions, People's Committees and Department of Agriculture and Rural Development (DARD), large traders and processors, cooperative directors, and advanced farmers. This continuous consultation process guided all aspects of the research and grounded it in local realities. Research findings were communicated to all stakeholders in real-time and then incorporated into stakeholders' practices and government plans and activities. As a result, research outputs in the initial years of the project were already tested and evaluated by stakeholders by the end of the project, stimulating changes in stakeholder behaviours and practices within the project's timeframe.

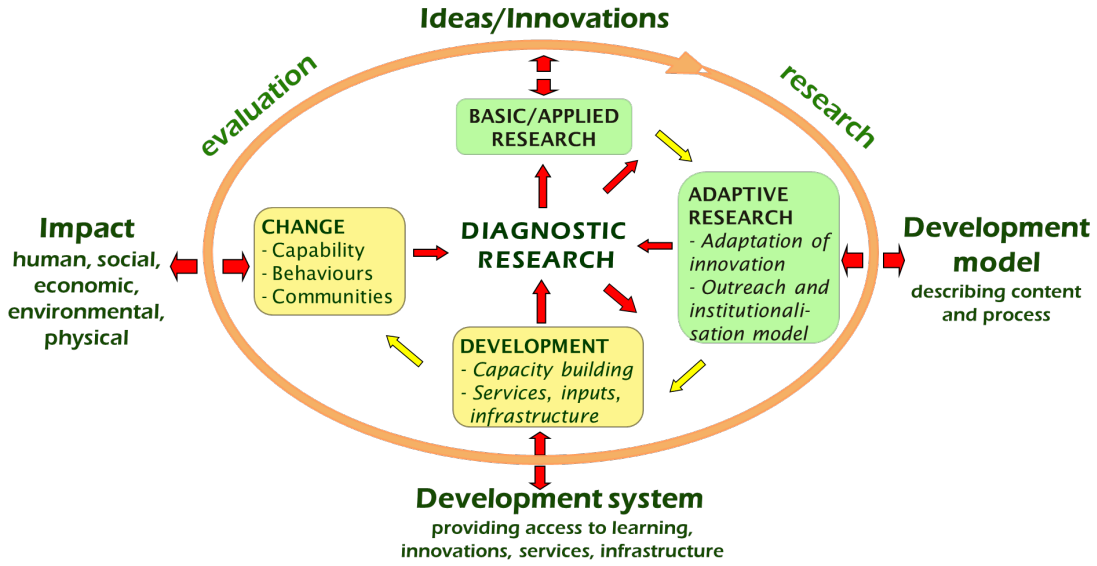


Figure 2: The framework for the agricultural research for development used to guide the project implementation.

Project activities were clustered in four components: two were research-based components comprising market and consumer research, and research on barriers to adoption of technical innovations by farmers and other stakeholders, and two components were designed to facilitate development, one through capacity building activities (stakeholder forums, study tours, cross-provincial visits, capacity building workshops) and another through the development of the pilot value chains (Fig 3).

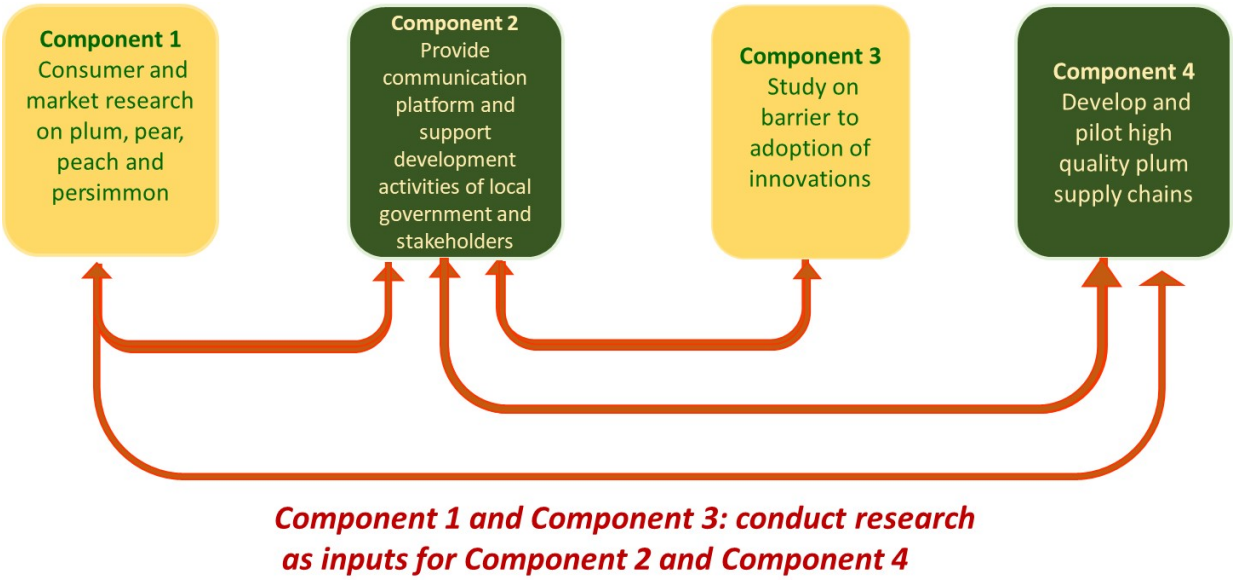


Figure 3: Schematic representation of the project components and the relationship between them. The research components are represented by yellow text boxes and development components by green boxes.

The development activities within the project were mainly financed by local government or private sector stakeholders themselves. The project management team had regular meetings with the officials at the provincial and district level and provided frequent written updates on project activities to secure active participation and external funding. With private sector stakeholders, regular visits to their properties were complemented with annual stakeholder workshops. Provincial and inter-provincial forums were a major platform for communicating research results and development activities, formulating further activities, and influencing policies and private stakeholders activities (more on forums in Section 7.12.2).

6 Achievements against activities and outputs/milestones

Objective 1: To evaluate consumer and market dynamics and opportunities at the local, provincial, national and regional levels.

No	Activity	Outputs/ milestones	Completion date	Comments
1.1	Analyse secondary data on demand, seasonality, supply, quality attributes, price and consumption trends for targeted fruits in Vietnam and China.	Report describing demand, seasonality, supply, price and consumption trends for targeted fruits.	Mar 2015	Based on existing literature and official data from the local government, VNUA and FAVRI have conducted an overall review and analysis on the production and market of plum, peach, persimmon and pear from Son La, Lao Cai and Lai Chau. This activity aimed to provide general information on: • Available varieties for each fruit • Production areas • Production volume • Marketing/trade The review and analysis were used to determine areas of focus for other studies in this component.
1.2	In collaboration with AGB 2012/059 develop instruments for structured farm and consumer surveys for quantitative characterisation of production, marketing, consumer and preferences.	Survey instruments and guidelines developed.	Dec 2014 FAVRI, HUA and CASRAD	Questionnaires for plum and pear farm surveys, and questionnaires for pear and persimmon consumer surveys were completed and used to implement those surveys (activity 1.5 and 1.6) Questionnaires are included in appendixes of reports of activities 1.5 and 1.6
1.3	Conduct semi-structured survey of conventional and modern retailers in Ha Noi to determine key issues related to TF marketing.	Report focused on key issues and implications for the development of the NW TF industry.	Preliminary May 2015 Final Dec 2017 FAVRI and HUA	Two semi-structured surveys in Hanoi, one on safe-food retailers (modern retailers) and one on conventional fruit shops, were conducted in late 2016 and late 2017. These surveys were designed to understand different retailers' business activities, products, product requirements, product sourcing behaviours, and sale patterns and volume. Reports on these surveys are completed and finalised.

No	Activity	Outputs/ milestones	Completion date	Comments
1.4	Conduct semi-structured survey with assembly traders in major production centres (Lao Cai and Moc Chau), and urban wholesalers in Ha Noi and Ho Chi Minh City to determine key issues related to TF marketing.	Report focused on key issues and implications for the development of the NW TF industry.	Sep 2015 HUA , CASRAD and FAVRI	Work on collectors and assembly traders at local productions areas (Moc Chau and Lao Cai) was conducted in 2015. In 2018 few additional interviews were carried out in Moc Chau, and a new framework was developed to consolidate all collected data. The results were presented in the final review, and the presentation can be downloaded in the section of activity 1.12. A summary of the results is presented in the result section of the report. Surveys on wholesalers in Long Bien (Hanoi) and Thu Duc (Ho Chi Minh City – HCMC) wholesale markets were conducted, and reports were completed.
1.5	Conduct structured farm surveys in production areas of Bac Ha, Moc Chau and Lai Chau	Report presenting a quantitative characterisation of production and local marketing systems for TF and key implications for the development of the NW TF industry.	Sep 2015 CASRAD, PPRI and FAVRI	Plum farm survey was conducted in Son La province (Moc Chau and Van Ho district) and Lao Cai province (Bac Ha district). Lai Chau was not included in the survey as there is no significant production of plums there. The survey's aim was to understand farmers' orchard characteristics (varieties, size, source of seedling) and farmers' practices (fertilisation, pesticide application, pruning, etc.) and use of labour. Production of non-astringent persimmon and peach fruit in the Northwest is still very negligible. However, a short study on peach blossom was conducted and was presented as PowerPoint presentation at the final review. Results are presented in the result and discussion section.

No	Activity	Outputs/ milestones	Completion date	Comments
1.6	Conduct structured consumer survey covering urban markets near production areas (Lao Cai City, Lai Chau City, Son La City) and major urban centres (Ha Noi).	Report presenting a quantitative characterisation of consumer behaviour and preferences and key implications for the development of the NW TF industry.	Dec 2014 HUA , CASRAD, and FAVRI	Consumer surveys on pear and persimmon were conducted in Hanoi city. Both targeted fruit buyers at different types of retailers (supermarkets, traditional fruit shops, wet markets and street vendors). The aim of these surveys was to study consumers' behaviour (where do they shop, and at which frequency they buy pear/persimmon), identify their preference in regard to types of pear/persimmon available in market, origin, packaging, labelling and assessing their perception and concern about food safety. A consumer survey on plum was conducted during the previous project and, therefore, not repeated. The University of Adelaide, as a part of ACIAR AGB/2012/059, conducted a household consumer study about fruit and vegetable in Hanoi. Following an agreement between 2 projects (AGB/2012/059 and AGB/2012/060), the Adelaide team included plum, persimmon and pear in their study. Preliminary report attached. As peach production in Vietnam is still insignificant and rarely reaches Hanoi market, we did not conduct a consumer survey for peach in Hanoi. Due to financial constraints, the project team was unable to conduct a consumer survey outside Hanoi
1.7	Focused consumer research (FGD, consumer evaluations) for non-astringent persimmon	Report presenting consumers' varietal and other preferences for non-astringent persimmon and key implications for the development of the NW TF industry	Dec 2015 CASRAD and FAVRI	Focus consumer group discussion was conducted in Hanoi.
1.8	Mapping of current and potential areas (using agro-climate suitability, and local knowledge) of TF production varieties in Moc Chau, and Tam Duong	Report that includes maps of current and potential TF production areas	Tam Duong Dec 2015 Moc Chau Dec 2017 CASRAD PPRI May 2017	GIS maps for Sin Ho and Tam Duong districts in Lai Chau and Moc Chau district in Son La were developed to identify areas with suitable CU level for temperate fruit production. These maps were sent to local governments in both provinces.

No	Activity	Outputs/ milestones	Completion date	Comments
1.9	Develop instruments and organise continuous monitoring (over 3 years) of wholesale markets in Ha Noi	Monthly, quarterly and annual reports presenting quantitative price and volume data and the implications for the development of the NW TF industry.	Progress reports Dec 2015, 2016, 2017. Final report Mar 2018. HUA	Long Bien is the main fruit wholesale market in Hanoi. Over 2015-2017 period, data on wholesale price and volume of four temperate fruits (plum, pear, persimmon and peach) in Long Bien wholesale market was recorded. As price, volume and trading periods of domestic fruits and import fruits (from China, US, Korea and South Africa) were analysed and compared, we identified and assessed competition forces that challenge domestic production, and identified market windows for domestic producers (which will require new varieties that bring earlier harvest). Results were consolidated into one final report.
1.10	Develop instruments and conduct surveys on farm gate production in Moc Chau and Bac Ha.	Report presenting quantitative data on TF export and import flows and the implications for the development of the NW TF industry.	Progress reports Dec 2015, 2016, 2017. Final report Mar 2018. FAVRI	Data on local collectors' price and volumes of plum and persimmon in 2 production areas (Moc Chau and Bac Ha) was recorded over the period 2015-2017. Separate reports for each year are completed.
1.11	Conduct interviews with traders and government agencies in provinces bordering China.	Report on cross border trade flows between Vietnam and China, including volumes and seasonality, and implications for the development of the NW TF industry.	May 2017 UQ/UA	In 2007, unripe plum (also known as green plum) from Moc Chau and nearby districts in Son La provinces started to be exported to China. Over years, export of green plum grew larger and larger, becoming a significant source of additional income for farmers at disadvantaged areas (where nature conditions are not favourable for production of high-quality plum). However, prior to 2013, little was known about green plum trade activities at the borders (which actors are involved, and how price and volume are determined), and green plums' final destination in China. This lack of information meant no recommendations or strategies could be made. To fill in this information gap, the study of the unripe plum supply chain from Moc Chau to processing factory in Pu Nin, Guangdong province, was conducted between 2013 and 2017. The initial study was conducted as part of the previous project. Under this project's scope, two additional trips to China were organised, and important updates and recommendations were made. Note: results of this study were communicated to the local government in Lao Cai, Son La, and Lai Chau provinces through forums and follow-up meetings.

No	Activity	Outputs/ milestones	Completion date	Comments
1.12	Undertake analysis of supply chains for plum, peach and persimmon from Moc Chau and plum and peach from Bac Ha to Ha Noi, HCMC and China.	Report presenting chain structure, conduct and performance and the implications for TF chain innovation strategies and interventions.	Dec 2018 Moc Chau CASRAD Bac Ha FAVRI	A framework has been developed to consolidate information from various reports in this component, map the supply chains for plum, and assess the attractiveness of different market segments for actors in the plum chain. The results are presented in the results and discussion section.
1.13	Consultations with key stakeholders to review and identify interventions opportunities in Moc Chau and Bac Ha.	Report presenting chain innovation strategies and interventions.	Preliminary Sep 2015 Final Dec 2017 CASRAD FAVRI (Bac Ha)	Multiple meetings with local governments, traders, collectors and farmers were conducted regularly in Moc Chau and, to a lesser extent, in Bac Ha. As a result, two collectors in Moc Chau were identified as key actors in the development of a plum value chain. Further results are presented in Objective 4.

PC = partner country, A = Australia

Objective 2: To support government-led planning, coordination and development of the temperate fruit industry across Son La, Lai Chau and Lao Cai.

No.	Activity	Outputs/ milestones	Completion date	What has been achieved?
2.1	Provincial level meetings to introduce key project concepts and develop plans for provincial and regional forums, and capacity building workshops. Forums will seek to understand and influence how and where the Government investments are made in temperate fruit research and industry development, and in particular the current and potential role of the private sector and PPP	Report on provincial level meetings including industry and development goals, current programs, issues, constraints, opportunities and priorities for future action	Dec 2014 FAVRI responsible for report; all partners to participate at the meetings.	Concept of a comprehensive strategic plan, which is designed to link and coordinate all industry stakeholders for the development of temperate fruit industry, was developed around early 2017. After the first draft strategic plan was presented to provincial DARDs in Son La, Lao Cai and Lai Chau, the project has been organising regular meetings with the provincial government to receive inputs/feedback and continue adjusting the plans. Due to a lack of local's willingness to engage and participate in this process, the project dropped this activity in Lai Chau. However, Son La and Lao Cai local government continued to provide supports and contributed with their own ideas, one of which was the Industry Association initiative.
2.2	Establish linkages between provincial/district government agencies and research institution to provide technical support for development of TF production.	Annual reports on support provided.	May 2015, 2016, 2017 and 2018. PPRI; PPSD Lao Cai, NOMAFSI Sapa Centre	Linkages established.
2.3	Develop monitoring and evaluation of the impact of support activities on all stakeholders	Annual reports on monitoring and evaluation	May 2015, 2016, 2017 and 2018.	PME consisted of the continuous consultation process with representatives from provincial and district government institutions, People's Committees and Department of Agriculture and Rural Development (DARD), large traders and processors, cooperative directors, and advanced farmers guided research and ensured that the research was grounded in realities, findings were communicated to all stakeholders in real-time and then incorporated in stakeholders' practices and government plans and activities.

2.4	First provincial forums: Son La, Lai Chau and Lao Cai	Report on forum outputs including outline of developed strategies, issues, programs and post forum activities with participants' evaluation.	May 2015 FAVRI responsible for report; all partners to participate	First forums were organised in Son La and Lao Cai to communicate result from project's market research component to local government. These results were later transferred to DARD Moc Chau, and CPPSD in Lao Cai province.
2.5	Continuous on-the-job mentoring and short training activities in area of: Interpretation and utilisation of market and consumer data	Report on training activities	Continuous until Sep 2018 CASRAD and HUA responsible for organisation; inputs from all partners.	Regular training of staff conducted by Dr Oleg Nicetic, Mr Tiago Wandschneider and Dr Phillip Currey.
2.6	Mid-term review	Report on MTR review	March 2017 FAVRI responsible for report; all partners to participate	MTR conducted. The chief reviewer did not submit the report.
2.7	Second provincial forums: Son La, Lai Chau & Lao Cai	Report on forum outputs including outline of developed strategies and post forum activities with participants' evaluation.	May 2016 FAVRI responsible for report; all partners to participate	Under-developed nurseries industry with poor management of varieties (both rootstock and mother orchard), low maintenance of phytosanitary standards, and no capacity to manage and protect modern varieties (most of which requires royalty) are identified to be one major barrier to North West's temperate fruit development. To raise nursery industry and local governments' awareness on these issues, the project commissioned an ex-nursery owner and manager from Australia – Peter Young – to assess seedling production of several local nurseries in Son La and Lao Cai (Lai Chau is not included as their seedling production is still small) and present these results in the second provincial forums in 3 provinces (see nursery report). Peter also shared his experience on modern nursery practices and the Australian nursery industry's self-regulation.

2.8	Continuous on-the-job mentoring and short training activities to improve understanding technical aspects of temperate fruit production and postharvest.	Report on training activities	Continuous until Sep 2018 PPRI responsible for organisation; inputs from all partners	Replicated trials on plum thinning and pear fruit bagging have been conducted. Postharvest training activities were replaced with auditing of fruit quality in wholesale markets and retail. Results of the pear trial and wholesale auditing are presented in the result section of the report.
2.9	First Interprovincial forum: Son La, Lai Chau, Lao Cai	Report on forum outputs including outline of developed strategies and post forum activities with participants' evaluation.	June 2017 FAVRI responsible for report; all partners to participate	The first inter-provincial forum was organised in April 2017 with the topic of geographic indication and branding for temperate fruits. More than 40 people, including government representatives, traders and cooperatives from Son La, Lai Chau and Lao Cat participated in the forum. The project invited Dr Delphine Marie-Vivien, an expert on branding and GI from CIRAD to give a presentation about a different form of brandings (with or without geographical element), and facilitated discussion on how to choose the appropriate form of branding based on market conditions, customer preferences and local situations.
2.10	Third provincial forums: Son La, Lai Chau, Lao Cai.	Report on forum outputs including outline of developed strategies and post forum activities with participants' evaluation.	Sep 2017 FAVRI responsible for report; all partners to participate	The project team decided to merge the third provincial forums with the second interprovincial forum, and the fund initially allocated for these activities was used to finance the final review.
2.11	Continuous on-the-job mentoring and short training activities in area of: Participatory outreach methods and adult action learning processes	Report on workshop with participants' evaluation. Booklet with a compilation of the presented material.	Continuous until Sep 2018 NOMAFSI responsible for organisation; inputs from all partners	

2.12	Second interprovincial Forum: Son La, Lai Chau, Lao Cai (+ minor representation from Yen Bai, Hoa Binh Ha Giang, Cao Bang)	Report on forum outputs including outline of developed strategies and post forum activities with participants' evaluation.	July 2018 FAVRI responsible for report; all partners to participate	The second forum was organised on the second day of the final review workshop in Moc Chau. In addition to forum participants (project team, government representatives from Son La, Lai Chau and Lao Cai and reviewers), participants also include businesses (cooperatives and private companies), nurseries, traders and big growers. The project team presented the strategic plan for developing the temperate fruit industry in the Son La and Lao Cai provinces. The initiative to introduce modern temperate fruit varieties into Vietnam and form an industry association were discussed. Discussions were centred around how to form a functioning association with multiple stakeholders and what benefits the association could bring to its stakeholders; what mechanisms need to be developed for us to conform to the international standard on varieties protection and management, and what the challenges might be encountered. The forum was a stepping stone for decision by the People's Committee of Son La province to form the Temperate Fruit Association and for the development of the follow-up SRA AGB/2018/171 to support the formation of the Association and the introduction of varieties.
2.13	Evaluation of forums and facilitation and learning methods used	Report on evaluation Scientific paper on the effectiveness of forums in the facilitation of government-led development p	Interim reports Dec 2015, 2016 and 2017. Final report May 2018. May 2018	Evaluation of the forums was done through key informant interviews, and results are summarised in the result section of the report. There is no enough material for the scientific paper since the focus shifted to the Strategic plan for industry development, which was not envisaged in the original project proposal.

Objective 3: Overcome barriers to adoption of improved varieties and cultivation techniques currently constraining development of the temperate fruit industry in NW Vietnam.

No.	Activity	Outputs/ milestones	Completion date	Comments
3.1	Comparative case study and review secondary data on introduction of TF production and adoption of TF production, postharvest and marketing innovations in NW Vietnam with focus on ethnic minorities and their geographic isolation, access to information, prejudice, institutional access. .	Report on adoption of TF production, postharvest and marketing innovations	Dec 2014 NOMAFSI PPRI FAVRI	Five past projects that worked with temperate fruits in Northwest Vietnam funded by international and national funding bodies were selected and analysed to identify factors affecting their success or failure.
3.2	Conduct key informant interviews and scenario analysis with a) government officials on national, provincial and district levels; b) extension services on national, provincial and district levels; c) key collectors and wholesalers on district and communal level; d) large and small farmers; to gain an understanding of past, current and planned TF development, policies, institutional engagements, successes and failures in TF development and, rural innovation communication strategies and mechanisms. Ethnic minorities' issues, including their geographic isolation, socio-economic status, access to information and institutions, will be specifically targeted.	Report on passed, current and planned TF development, related policies, institutional engagements and, rural innovation communication strategies and mechanisms.	Dec 2015 NOMAFSI	Personal interviews and focus group discussions were conducted with a range of stakeholders (local government, researchers, extension officers and farmers). These primary data were complemented by a thorough analysis of secondary data on past and current development of temperate fruits in Northwest and related policies.

3.3	Conduct key informant interviews to evaluate options for financing and public-private partnerships, or private sector-led TF development with specific focus on differences between Kinh people and ethnic minorities: a) past practices b) current options	Progress reports and briefings for Forums Report on past practices and current options for financing TF development.	Mar 2015, Sep 2015, Mar 2016 Dec 2016 HUA	Interviews with local governments (DARD and PC) and mass organisations at the district level and with financial institutions (e.g. commercial bank and credit union) were conducted in April 2018 to identify available options for funding. Further interviews with local government and mass organisation at a lower level (commune and village) were carried out in July 2018 to complement results from past interviews. This activity was implemented in conjunction with the institutional mapping activity of other ACIAR projects (vegetable and maise). The results are synthesised and presented in the result and discussion section.
3.4	Conduct comparative ethnographic research including collecting stories, group discussions, and scenario analysis with H'mong, Dao, Thai and Kinh ethnic groups in Moc Chau and H'mong and Kinh ethnic group in Bac Ha to increase understanding of farmers' beliefs and perceptions related to: a) fruit and forest trees and their utilisation. b) government run development projects c) engagement with financial institutions and markets.	Progress reports and briefings for Forums Report and scientific paper on farmers beliefs and perception on fruit and forest trees and their utilisation	Mar 2015, Sep 2015, Mar 2016 Sep 2016 NOMAFSI	Individual interviews and group discussion with farmers from different ethnic groups within the scope of activity 3.4a and 3.4b were completed. The results were summarised in a short report. Activity 3.4c is designed to complement results from activity 3.3 (by looking at financing options for farmers from farmers' own perspective). Fieldwork for activity 3.4c was be implemented in July 2018, and results are presented in the final report.
3..5	Detail costing and disaggregated workload specification specific for age and gender for technical protocols for TF production developed in previous projects or promoted by DARD.	Report on feasibility of TF production protocols to be implemented by smallholders specific to socio-economic context of ethnic groups in targeted NW provinces.	Mar 2015	Information for the analysis was collected during the plum farm survey (activity 1.5)' and the results are presented in the plum farm survey report. A summary of the analysis can be found in the result section.
3.6	Write regular briefings for forums and discussion paper with comprehensive synthesis of analysis 3.1-3.5	Briefings Discussion paper	Mar 2015 – June 2018 June 2016	Input into forums and NW Symposium provided.

3.7	Evaluate extension training methods, consolidate and adapt outreach materials produced in previous ACIAR and other international and national projects ensuring materials suit needs of ethnic minorities.	Report on evaluation of extension methods. Resource material including production, postharvest and marketing manuals, booklets, and information sheets.	May 2015 May 2017 NOMAFSI (lead) all partners contribute	Extension materials (including presentations, training documents, manuals/books, and scientific articles) were collected and analysed by a group of experts from the Agriculture and Forestry Faculty, Hue University.
3.8	Develop and facilitate implementation and evaluation of culturally appropriate outreach strategies for scaling up TF production and TF marketing models. Conduct training and capacity building workshops for leader farmers, traders and provincial extension services.	Scaling up strategies documented, implemented and evaluated. Provincial training workshop conducted and evaluated.	Preliminary Mar 2016 Final Mar 2018 NOMAFSI	Due to lack of funds, this activity was implemented in Tam Duong district, lai Chau province in conjunction with a locally funded project.
3.9	Policy advice for development of TF industry to MARD and DARDs in provinces with current and potential TF production.	Policy briefs submit to relevant institutions and feedback recorded.	Mar 2018 NOMAFSI	Based on a thorough assessment of local situations and following the strategic plan, detailed policy recommendations were made and communicated with local governments. These recommendations centres around three main activities: -To facilitate the development of a temperate fruit industry association to -To introduce modern varieties with specific traits that can address current issues in productions and along the supply chain (e.g. earlier harvest to avoid fruit flies, tougher flesh to reduce loss during transportation, better appearance to suit customer preferences, etc.) -To collaborate with association and nurseries to develop mechanism to protect these varieties and collect royalties, ensuring compliance with international standard of variety protection. These recommendations were very well-received by Son La province's local government, and real initiatives were developed based on them.

Objective 4: Develop competitive consumer-driven marketing models for engagement with more profitable markets

No.	Activity	Outputs/ milestones	Completion date	Comments
4.1	Meetings with key stakeholders to select the communities, farmers and traders that will be involved in supply chain upgrading and development processes.	Meeting reports. Value chain development opportunities, communities and participants identified.	Dec 2015 CASRAD (Moc Chau- plum perssimon) FAVRI (Bac Ha-plum) PPRI (Tam Duong -peach)	Regular meetings conducted. See report 4.6
4.2	Selection of indicators for monitoring and evaluation of chain outcomes and impacts throughout the project. Measurement of current chain performance using product/price/quality matrices and efficiency/ flexibility/quality matrices and gross margin analysis.	Report. Monitoring and evaluation indicators selected and chain baseline performance measured	Sep 2015, 2016, 2017 and 2018 CASRAD (Moc Chau) FAVRI (Bac Ha) PPRI (Tam Duong)	VC performance is presented in report 4.3.
4.3	Development of evaluation procedures and participatory assessment of chain outputs, outcomes and impacts, with an emphasis on chain efficiency and competitiveness, and farm net-income impacts.7	Guidelines and instruments for assessing the outputs and outcomes produced. Report and scientific paper on implementation of VC improvement interventions and household benefits.	Guidelines Dec 2014; Baseline report Sep 2015 Progress report Dec 2016, and 2017; Final report and paper Mar 2018.	Performance of high quality plum chain was monitored on a regular basis in 2016, 2017 and 2018. Summary of this chain's performance can be found in the abstract below.

4.4	Initial stakeholder workshops for all target chains involving chain participants as well as local government agencies, community representatives and NGOs in the area	Workshop reports. Key chain participants and support stakeholders are aware of chain development strategies and interventions.	Mar 2016 CASRAD FAVRI (Moc Chau)	Workshop conducted. See report 4.6.
4.5	Workshops and training for researchers and partner stakeholders to address capacity that will support implementation and monitoring of chain interventions.	Workshop reports, including evaluation by participants.	May 2016 May 2017 All research partners	Training conducted on a regular basis.
4.6	Participatory process of intervention prioritisation and selection. Development of value chain development plans.	Work book for chain interventions. Detailed implementation plans.	May 2016 May 2016 Regular revisions 2017 and 2018. All research partners.	Intervention prioritised. Report attached.
4.7	Identify and engage lead farmers, input suppliers and traders in training, capacity building and communication activities to enhance research adoption and project impact.	M&E report on training, research adoption and communication building activities	Mar 2017 Mar 2018 CASRAD and FAVRI	Identified key stakeholders were engaged in the formation of Son La Temperate Fruit Association. They were trained in phytosanitary management of nurseries and collection of market intelligence.

4.8	a) Implementation of interventions in new VC with committed stakeholders, including business workshops, "walking the chain" activities, demonstrations and feasibility studies, as well as market feed-back and feed-forward communication. b) Implementation of simpler interventions in existing supply chains to improve their performance.	Report on changes in VC performance before and after intervention for each target chain. First and second cycles of chain improvement activities completed and documented.	Sep 2016 Sep 2017 CASRAD, FAVRI (Moc Chau)	Report for 2016 attached. Two cooperatives were formed, training on GAP conducted and a Safe Fruit certificate issued.
4.9	Conduct fruit quality audits across market segments	Report on the analysis of fruit quality across market segments	Aug 2018	In 2016 and 2017, plum samples were collected from production areas and different market segments (traditional and modern retail segment) in Hanoi for quality analysis. Combined report for both 2016 and 2017 plum quality audit was finalised in May 2018
4.10	Visit to China of key Vietnamese stakeholders involved in export supply chain of processing plums to China	Report on visit to China and evaluation of the visit by the participants.	Dec 2017	Two trips to the processing area of China were organised in August and November 2018. A total of eight representatives, including Moc Chau local government, traders/farmers who have both financial capital and interest in plum processing and Vietnamese research institutions, visited Pu Nin and met with five plum/apricot processors in China to explore potential for cooperation for joint investment in processing facilities in Son La province and to evaluate benefit/risk of this cooperation. Updates from these two trips are included in the green plum study report (section A1.11)
4.11	Conduct training to improve capacity of nursery staff to plan and implement the technical and management changes necessary to facilitate the nursery's transformation to satisfy regional TF nursery material needs.	Report on training activities and business plan	Dec 2017	Two training were conducted

PC = partner country, A = Australia

7 Key results and discussion

7.1 Introduction

The result section is organised into four sub-sections. The first subsection summarises the three-year monitoring of plum, pear, peach and persimmon trade in the Long Bien market from March 2015 to January 2018. The data were collected daily and included the origin and varieties of focus fruits and their traded volumes and prices. The Long Bien market was chosen because, at the time, it was by far the largest wholesale market in Hanoi, and the assumption was that data could be used to understand the overall dynamics of the Hanoi TF market. The aim was to use this information to interpret production and trade data collected in TF production areas (Son La in Lao Cai) and guide provincial TF industry planning.

In the second sub-section, the results of the 2016 study of Hanoi's safe food retail sector are presented. The main aim of this study was to better understand the current and potential role of this emerging retail sector in developing value chains for high-quality TFs produced following VietGAP protocols.

The third sub-section presents an overview of the production and trading of four focus temperate fruits: plum in Son La and Lao Cai province, with a detailed description of plum market channels, which originated in the Moc Chau district of Son La province; the pear production and trading overview in Lao Cai province and peach and persimmon in Son La and Lao Cai provinces.

The fourth sub-section presents barriers to adopting new technologies by smallholder farmers, including the nature and suitability of technologies, design and implementation of projects, beliefs and attitudes of ethnic minorities towards projects and development, and access to finance.

Methods and discussion are included in each sub-section.

7.2 Trading of major temperate fruits in Hanoi's Long Bien wholesale market 2015 to 2017

7.2.1 Method

Data collection for plums started in March 2015 and was completed in November 2017, collection for peaches started on 29 April 2015 and finished in December 2017, pears started in June 2015 and finished in January 2018, and persimmon started in August 2015 and finished in January 2018.

The total trading volume of each fruit was recorded daily by Long Bien market manager Mr Nguyen Trong. The volume was recorded at the time when vans and trucks with fruit entered the market. It was assumed that the total volume that entered the market was sold, so it was a proxy for the total volume of fruit traded in the market for that day.

Prices from six traders were recorded daily between 1 and 2 am. Selling prices (i.e. price that includes wholesalers margins) were recorded per type and variety of fruit and per grade, but most fruits were not graded.

The **total daily traded value** was calculated using the following equation:

$$TVFP_i^d = \sum_{j=1}^{v} Q_{ij} * P_{ij}$$

$TVFT^d$ = total trading value for on a day *i*th

Q_{ij} = quantity of the specific variety (*j*) of the commodity traded on day *i*, and *v* is the total number of varieties of the commodity traded on the day *i*.

P_{ij} = average price from six traders of the specific ungraded variety (*j*) of the commodity traded on the day *i*

The **daily price** of the commodity (as a whole) is computed as a weighted average:

$$P_i^d = \frac{TVFP_i^d}{\sum_{j=1}^{v} Q_{ij}}$$

The **monthly price** of the commodity in the month *t*

$$P_t^m = \frac{\sum_{i=1}^{mt} TVFP_i^d}{\sum_{i=1}^{mt}\sum_{j=1}^{v} Q_{ij}}$$

mt = number of trading days for the commodity in the month

Results are presented as graphs.

7.2.2 Plum

Plums were traded over six months, from April to September. Nearly all plums sold in Long Bien are from Vietnam or China. Volumes imported from the United States, a third origin, have no statistical expression. In 2015 total of 24,507 t was sold, of which China accounted for 86% and Vietnam for 14%. Since then, the volume of Chinese plums decreased substantially from 21,158 t in 2015 to 5,782 t, while the volume of Vietnamese plums remained nearly constant; 3,349 t in 2015 and 3,608 t in 2017, with a peak in 2016 when 4,201 t was traded. There was a 62% reduction of total traded volume in three years, with Vietnamese plums increasing their market share from 14% to 34% (Fig 4). Price of the most traded Chinese variety, “purple plum”, reduced from an average of 25,500 VND/kg in 2015 to 17,453 VND/kg in 2017, while the average price of Vietnamese Tam Hoa plum increased in the same period from 19,790 VND/kg in 2015 to 26,638 VND/kg in 2017. A very small volume of the US “purple plums” was sold only in 2016 for 163,000 VND/kg.

There was little overlapping in the marketing of plums of the two origins. In Vietnam, most plums come from Son La and are picked from late April to late June, whereas Chinese plums start being imported as the Son La harvest is ending (Figs 5 and 6). Supply of plums from Bac Ha, Lao Cai province overlap with plums imported from China, but volume is low, and because consumers prefer Bac Ha plums their sale was not affected.

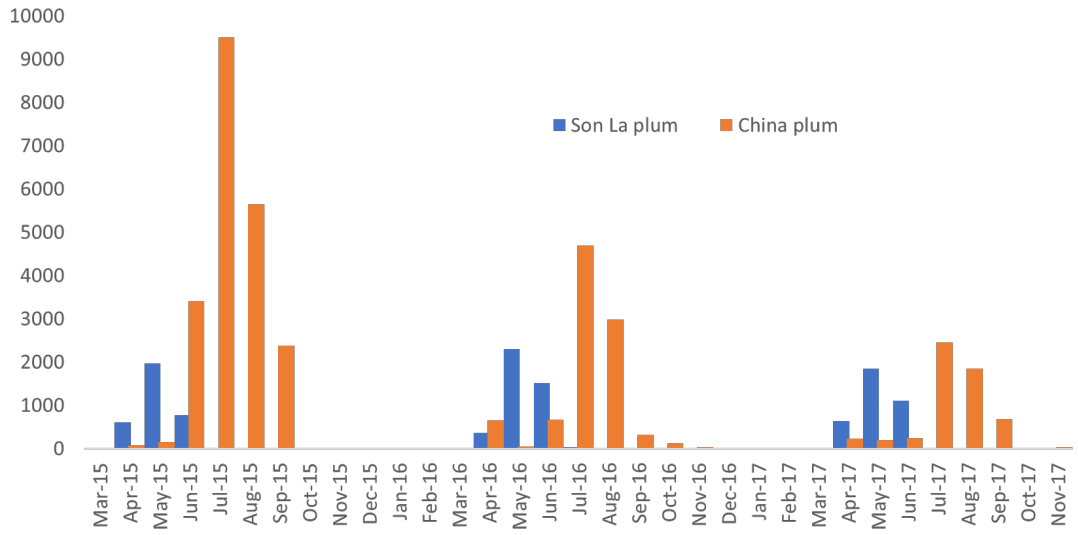


Figure 4: Volume of plums (kg) originated from China and Vietnam traded from 2015 to 2017.

The price of Vietnamese plums is much more sensitive to changes in supply than the price of Chinese plums, dropping significantly during the peak marketing weeks (Figs 5 and 6). Lack of varietal diversification (Fig 7) is a major reason why the market for Vietnamese plums is much smaller or "thinner" than for Chinese plums. Tam Hoa variety accounts for 90% or more of the supply from Vietnam, whereas eight cultivars are imported from China, stretching the plum season to five months.

The major competitive advantage of Son La province and Moc Chau district, in particular, comes from having an earlier crop of Tam Hoa plum than China. At harvest time, farmers have a largely captive domestic market. They can also export to China because at that time, local Chinese supply could not meet demand from Chinese processors and consumers.

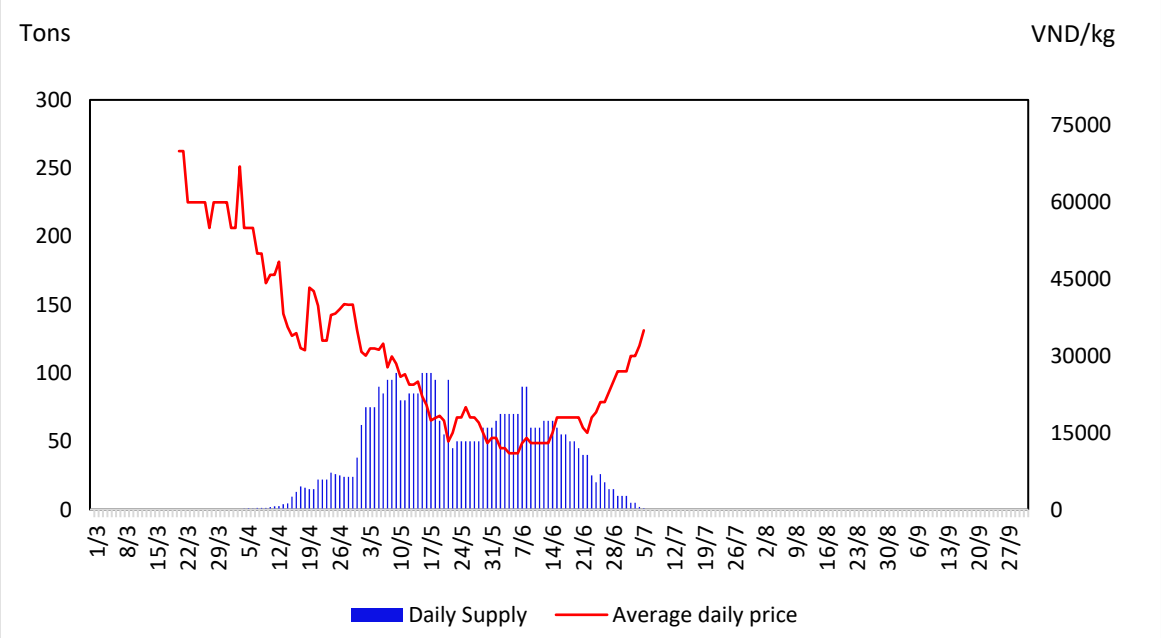


Figure 5: Daily wholesale supply and prices of Vietnamese Tam Hoa plums at Long Bien Market, Hanoi (2016)

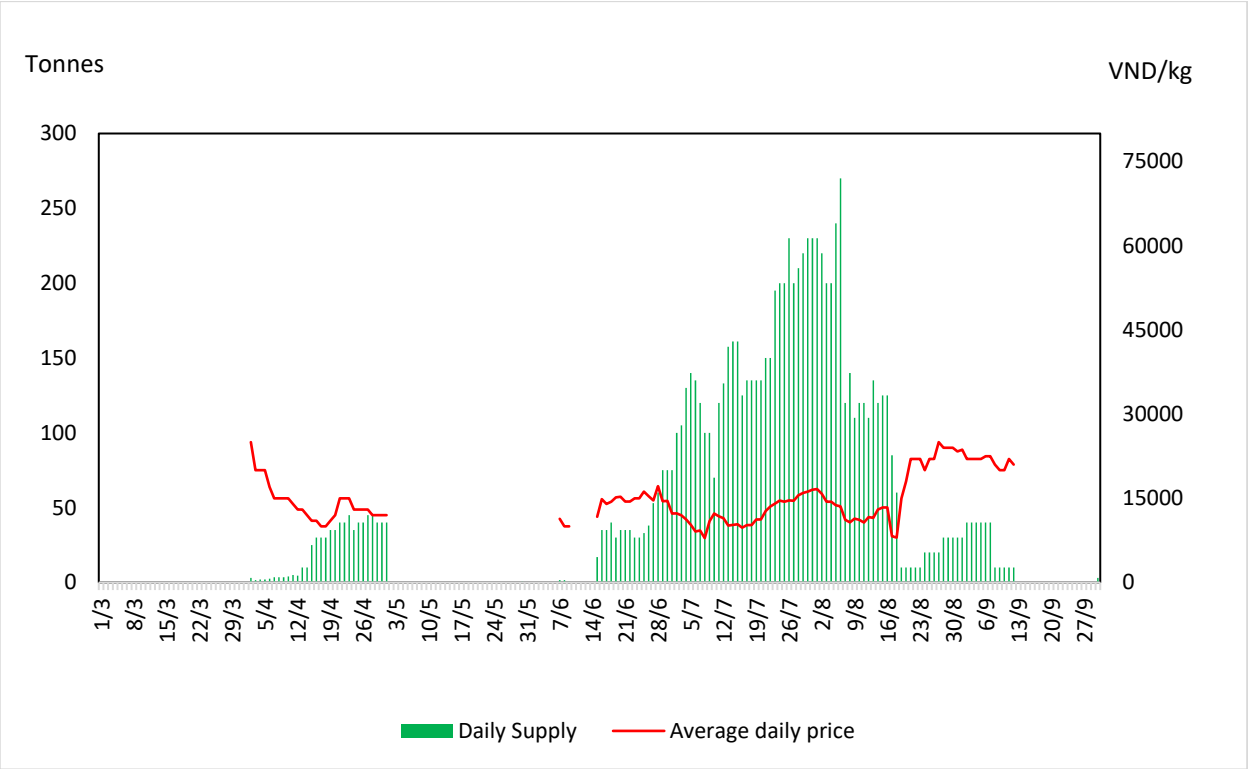


Figure 6: Daily wholesale supply and prices of Chinese plums at Long Bien Market in 2016

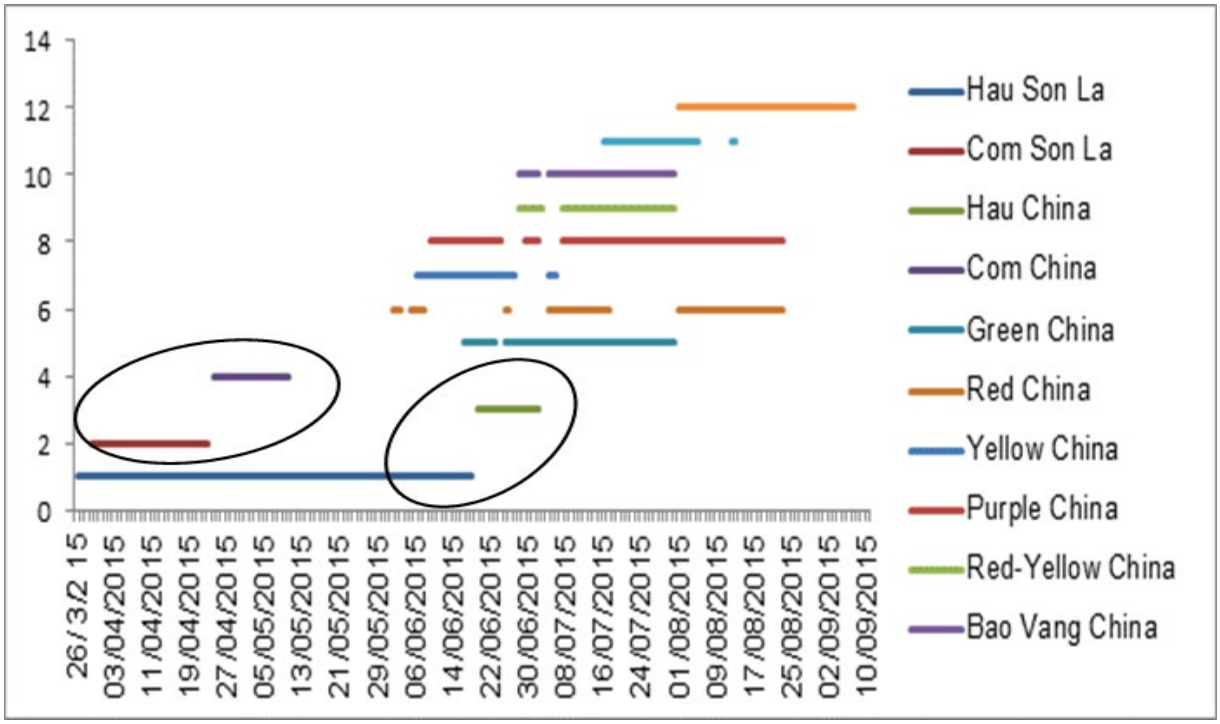


Figure 7: Variety traded at Long Bien Market in 2015

Implications for Son La plum production

The above results indicate that the current market conditions favour an expansion of production within Vietnam, but not by increasing the production of Tam Hoa plums. The

introduction of new varieties should be pursued in order to diversify and spread supply over time. This would mitigate the negative price impacts from increased production and reduce farmers' exposure to production and market risks. New cultivars need to be evaluated on the basis of agro-climatic suitability and consumer preferences and demand in Vietnam and China. Earlier varieties should be favoured in order to shield farmers from import competition.

There are possibilities to increase the income of Tam Hoa production through on-farm productivity gains, not through area expansion. This is critical for increasing farm profitability and farmers' resilience to negative price shocks. Unfortunately, a fast expansion of Tam Hoa growing areas in Son La was recorded in the study period (see 7.4).

Government should avoid subsidising new plantings of Tam Hoa plum. Instead, resources and efforts should be channelled towards enabling the adoption of farm management practices with the potential to increase yield, fruit quality, or both. The government also has an important role in selecting and disseminating new varieties and enabling the emergence of a thriving private nursery sector. Close collaboration between researchers, extension officers, farmers and private industry players has been essential and was facilitated by the project team.

7.2.3 Pear

All pears sold in Long Bien were from China, with only 28 t of Korean pears traded in 2016 and 2017 and 4 t from the US traded in 2016. There were no records of Vietnamese pears traded in the studied period. All Chinese pear varieties were round-shaped Asian species (*Pyrus pyrifolia*), with "Chinese yellow", as it is known in the trade, dominating supply and accounting for 80% of the wholesale trade in 2016 (Fig 8).

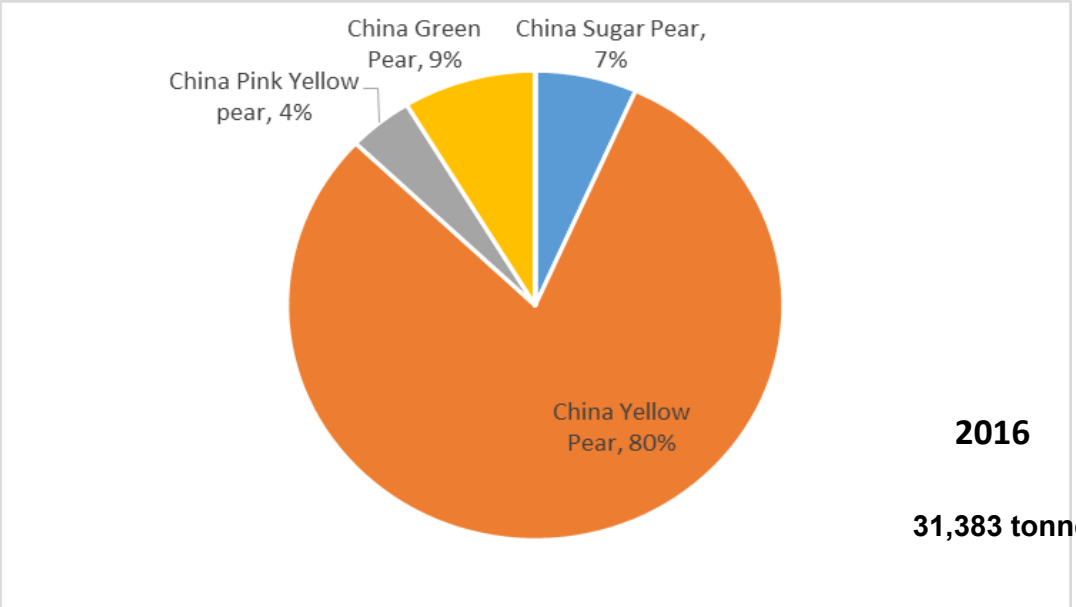


Figure 8: Pear varieties sold in Long Bien market in 2016

Pears from China were present all year round, but volume traded declined over the three-year monitoring period with 37,701 t, 31,383 t and 19,450 t recorded in 2015, 2016, and 2017 respectively. Prices were also reduced in the same period for all varieties sold, with the price of the dominant variety, "Chinese yellow", reducing from 14,000 VND/kg in 2015 to 8,300 VND/kg in 2017.

Analysis of the 2016 record shows that China's market dominance can be largely attributed to price. At Long Bien market, Chinese pear was four to ten times cheaper than

pear from South Korea or the United States (Figure 9).

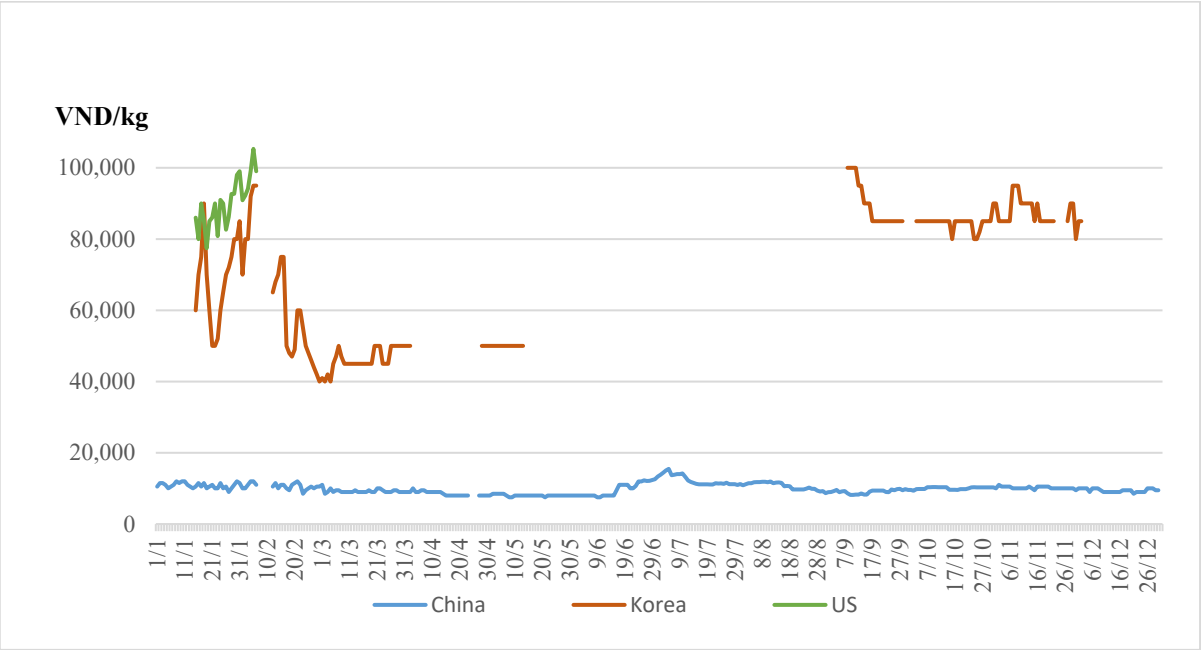


Figure 9: Average daily wholesale prices of pear at Long Bien Market in 2016

Figure 10: Wholesale supply and prices of pear at Long Bien Market in 2016

Supply was concentrated during the July-September months (Figure 10) when half of the total volume of pears was recorded. Surprisingly, there was no clear correlation between supply and prices. These peaked in July and August, which were also peak-supply months.

Implications for Lao Cai pear production

The emergence of Lao Cai as a pear producer will have a strong impact on domestic supply. It is projected that from 2025 onwards, 4,500 t of pear or more will be harvested every year within the province. Most of the crop will be marketed within a very short, three

to four week period, spanning from mid-June to mid-July. For comparison purposes, about 3,000 t were sold in the Long Bien market between 15 June and 15 July 2016.

Lao Cai farmers will face strong competition from China domestically. This competition will intensify as the local harvest season progresses. In late June 2016, the daily supply of Chinese pear at Long Bien market ranged from 50 to 60 t but tripled over the following two weeks, reaching 175 t on 15 July. Manipulating flowering and ripening to increase the proportion of early crops would be very beneficial.

The advantage of the Lao Cai VH6 pear compared to Chinese imports is a strong preference of Vietnamese consumers for domestically produced pears that are on par with Korean and Japanese imported pears sold for a much higher price than Chinese pears (see results of consumer research 7.4.4). It is likely that good quality VH6 pears could sell for 30-40,000 VND/kg, approximately half of the price for Korean pears and double the price of low-quality “Chinese yellow”e pear. Based on our estimation of production costs (see 7.4.3), this price would be very profitable for farmers. In 2018 the project team conducted a sensory evaluation of VH6 pear from Si Ma Cai (Lao Cai province), which compared preference for pears produced with and without bagging and showed that consumers preferred unbagged pears because of colour difference not taste. Bagged fruit is paler and nearly yellow compared to the brownish-green colour of unbagged fruit. The bagged fruit could easily be confused with Chinese yellow pear, the cheapest pear in the market. Further research is needed to establish if this market advantage of unbagged fruit outweighs the production benefits of bagging.

Seasonality and vicinity are potential sources of competitive advantage for Lao Cai VH6 pear export to the neighbouring Chinese province of Yunnan. VH6 pear can be harvested two to three weeks before pears grown in China’s pear production centre in Hebei, more than 2,000 km away. Further research is needed to better understand the market in Yunnan.

7.2.4 Peach

Peach was traded over five months, from May to September. All peaches traded in the Long Bien market in the period 2015 to 2017 were imported from China, except in 2016, when the presence of Vietnamese peaches was recorded but with only 0.1% share of the market. The volume traded was stable in this period with 9,026 t, 7,589 t, and 8,226 t traded in 2015, 2016 and 2017, respectively. The price for nectarines (locally called hairless peaches) reduced from an average of 13,250 VND/kg in 2015 to 11,770 VND/kg in 2017, and Mo Qua peach reduced from 23,000 VND to 19,000 VND/kg. While volume traded was stable, there was a significant change in the composition of traded varieties. Nectarines represented only 3% of traded volume in 2015, and their share increased to 42% in 2016 and 62% in 2017 (Fig 11).

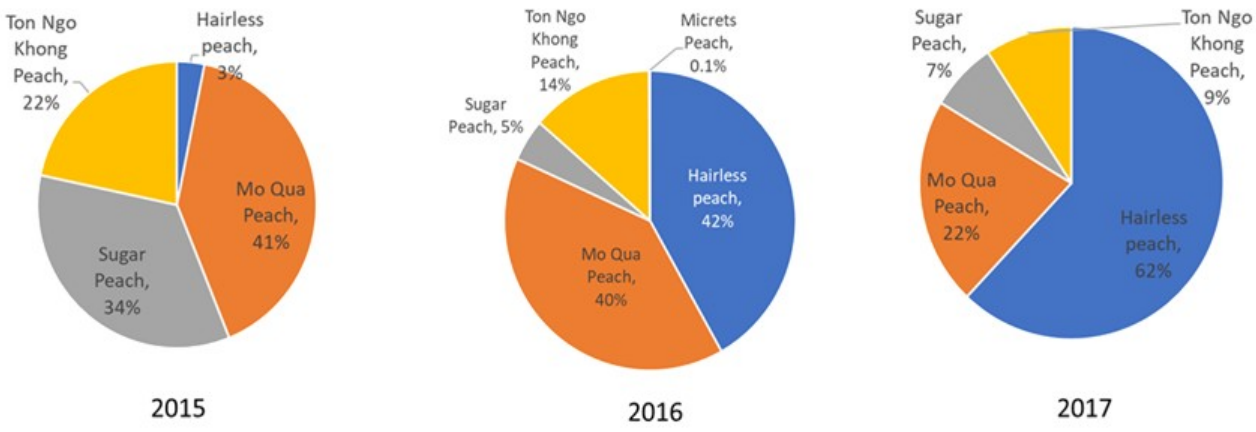


Figure 11: Peach varieties sold at Long Market in period 2015-2017

The prices within the season did not fluctuate significantly in 2016, varying between 13,000 and 19,000 VND/kg, and the increase in volume traded did not negatively impact price (Fig xxx).

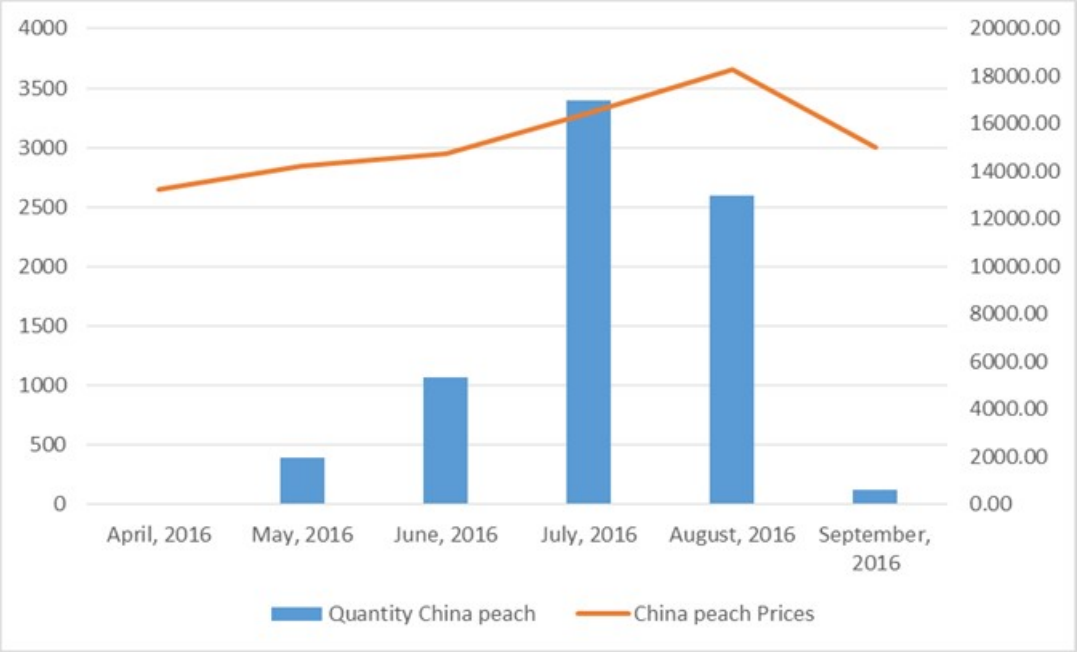


Figure 12: Wholesale supply and prices of peach at Long Bien Market in 2016

In conclusion, considering a strong preference for the fruit of Vietnamese origin, there is great potential to increase the production of high-quality peaches in Vietnam to compete with low-quality cheap imports from China.

7.2.5 Persimmon

Persimmon is traded from August to January, with the peak season usually in September to early November. In the monitoring period, 2015 to 2017, most persimmons traded in the Long Bien market (65-78%) were imported from China. The type of imported persimmon changed significantly during this period, with the non-astringent type accounting for only 10% of the market share in 2015 and reaching 63% in 2017 (Fig 13). However, the change is most likely due to the reclassification of persimmons recorded as astringent “plate persimmon” in 2015 to “non-astringent persimmon” in 2017. The names of varieties imported from China are unknown, and Vietnamese traders assign classification based on their observations. Our team established that persimmon sold as a non-astringent variety from China was not Fuyu or Jiro. The research team also established that Chinese non-astringent persimmon often had some residual astringency. The low level of residual astringency could be caused by harvesting non-astringent persimmons too early, the variety itself having low-level astringency, or astringent persimmons being soaked or other way treated to remove astringency. In any case, imported “non-astringent” persimmon was of low quality but competed with other types of persimmon by having the lowest price of 9,500 -13,000 VND/kg compared to 15,500-27,000 VND/kg for Lang Song persimmon. The farmgate price of non-astringent persimmon produced in Moc Chau (see Section 7.4.6) is more than double the wholesale price of imported Chinese non-astringent persimmon.

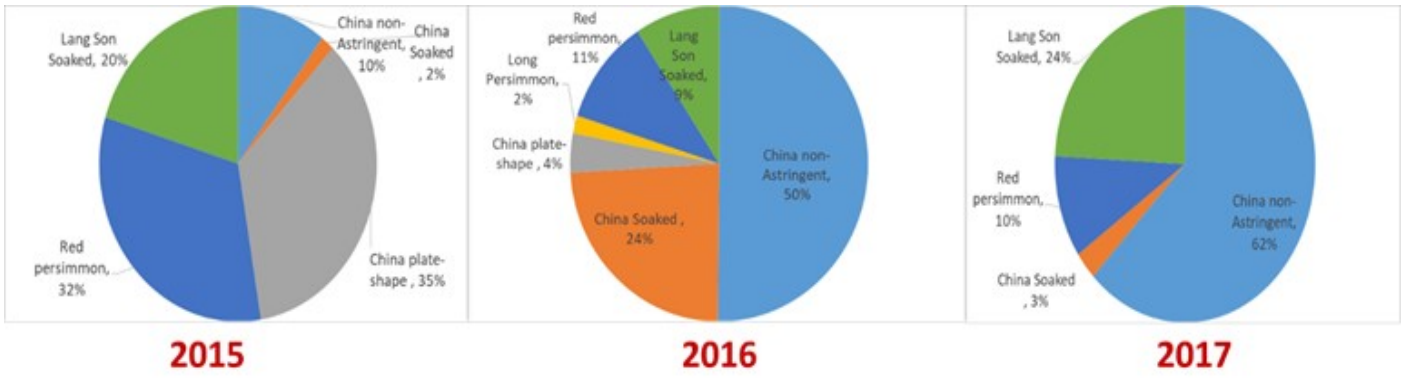


Figure 13: Persimmon types sold at Long Market in period 2015-2017

Lang Son soaked persimmons accounted for 20 and 24% of the market in 2015 and 2017, with a significant drop in market share to 9% in 2016. The price of Lang Song persimmon increased by more than 50% in 2017 compared to the previous two years (from 16,000 VND/kg to 27,000 VND/kg). The market share of red persimmon in 2015 was 32% but reduced significantly to 10% in 2016 and 2017. However, red persimmon consistently had a slightly higher price than Lang Son persimmon and more than 50% higher than Chinese imports. There was no clear inverse relationship between volume and price for Chinese imported persimmon.

The total volume of persimmon traded in the Long Bien market has decreased sharply during 2015-2017 (Fig 14). The total traded volume was recorded at about 19 thousand tonnes in the 2015-2016 crop season; it decreased significantly to about 9 thousand tonnes in the following season and dropped even further to 6.6 thousand tonnes in season 2017-2018. The sharpest decrease was in the traded volume of red persimmon, with over 6,000 t traded in 2015 falling to only 900 t in 2017. Our team could not record traded volume of red persimmon per origin because traders intentionally mixed low-quality red persimmon imported from China and red persimmon from Da Lat to label all of them as “Da Lat Persimmon” and profit on the consumers' preference for Da Lat origin. Most of the red persimmon sold in 2015 was likely from China, and Da Lat persimmon was sold in 2016 and 2017.

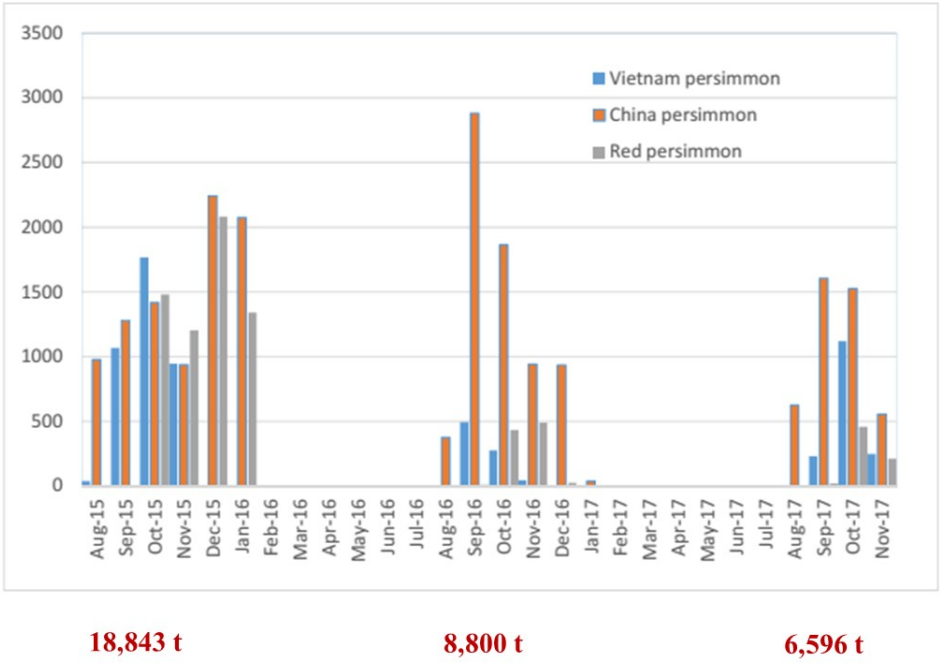


Figure 14: Wholesale supply of persimmon at Long Bien Market in period 2015-2017

Concluding remarks on Long Bien wholesale market study

This study was designed in 2014 to overcome the lack of statistical data on importing major temperate fruit from China. Nearly all fruit arriving in Hanoi from Lang Son border gates were part of the unrecorded trade following a cross border trade agreement that shipments with a value of less than 8000 CNY were not subject to customs duties and hence were not recorded in official statistics. This situation changed in 2019 when Chinese authorities imposed much stricter border controls with export and import quotas, and only registered export firms were allowed to perform cross border trade.
Another major change since the study's inception was the diminishing importance of the Long Bien wholesale market with government support to decentralise wholesale trade with preference and support for other wholesale markets across Hanoi and the fast development of supermarkets that source fruit outside the Long Bien market.
At the time the study was designed, it was a fair assumption that by monitoring the Long Bien market, we would capture nearly all of the fruit trade in Hanoi, and probably that was true for 2015 data, but it is unlikely that was the case for 2017 data, which may explain the sharp drop of traded volumes for all fruit investigated except peach. However, collected data were very useful to gain an overall understanding of the temperate fruit market and demonstrated to Provincial governments that they have to diversify production to escape oversupply and sharp price reductions. Data show that importers very skillfully regulated the supply volume from China so that traded volumes and prices were not negatively correlated, i.e. in months when sale volume peaked, the prices were also highest. In contrast, the relationship between sale volumes and prices is negatively correlated for Vietnamese fruit, with a dramatic reduction in prices recorded during peak plum season. There is a significant variation in quantities and varieties of fruits imported from China from year to year, indicating that imports from China are not part of any marketing strategy, but Chinese traders offer varieties of fruits when there is a surplus in Chinese markets. Finally, data indicated that Vietnamese fruits positioned themselves between cheap Chinese and expensive Korean and Western countries imports.

7.3 “Safe food shops” and their role in fruit value chains

7.3.1 Introduction

Since the mid-2000s, a new retail business model has developed safe food shops in response to increasing concern and awareness about food hygiene and safety in Vietnam. Numerous individual shops or small retail chains that specialise in selling allegedly safe agriculture products have been established, creating a relatively small but fast-growing retail segment in Hanoi and other major cities. Interestingly, they are regulated and officially registered as “safe food shops” based on the public health regulation that prescribes retail hygiene practices and not based on the regulations, certification and safety of agricultural products they are selling (e.g.VietGAP).

7.3.2 Methods

Key informant structured interviews were conducted with owners and managers whenever possible and with the retail staff in the outlets if the senior staff were unavailable, using a questionnaire. Two databases of safe food shops, one prepared by Fruit and Vegetable Research Institute (FAVRI) and one available on the website http://www.soff.asia were used as a reference to select retailers included in the survey. All safe-food retail chains with more than four outlets from either of these lists were included in the survey, except for Michi Mart.

Structured interviews were conducted with respondents from 35 safe-food shops/chains but only results from 30 shops/chains (with 87 outlets in total) that sold either plums, persimmons, peaches or pears in 2016 were included in the report.

Results from the structured questionnaires were also complemented by additional information obtained from conversations with interviewees and an investigation of retailers' online resources, including websites and Facebook pages.

7.3.3 Description of safe food retail segment

The safe-food shop segment is quite fragmented. The majority of interviewed retail businesses (24) are small, with three outlets or fewer. Only six chains have more than three outlets, including:

- Bac Tom (20 outlets)
- Soi Bien (9 outlets)
- Clever Food (7 outlets)
- Top Green (7 outlets)
- Happy Mart (4 outlets)
- Big Green (4 outlets)

Out of 30 chains/shops included in the survey in 2016, 20 operate solely as retailers, and 10 act as both retailers and wholesalers for certain products. Most of these retailers-wholesalers had three outlets or less, and only four of them wholesaled temperate fruits, including:

- Donavi (Tam Hoa plum and non-astringent persimmon)
- DuDu Fruit Vietnam (imported non-astringent persimmon)
- Vinh Hoa shop (non-astringent persimmon)
- Tinh Hoa company (non-astringent persimmon, soaked persimmon and dried persimmon – however it stopped selling fresh persimmon in 2017)

Several factors limited the establishment of larger safe fruit wholesale businesses, with the retailers' preference for direct connection with suppliers in production areas being the major factor. Direct sourcing of fruits from the point of production (either collectors or producers) is part of the business model for most safe food retailers. Direct sourcing is a viable option even for small retailers due to the developed networks of collectors in production areas and the availability of small-scale freight services provided by inter-provincial bus companies with shipments delivered to the My Dinh bus station in Hanoi. Other important limiting factors are difficulties in post-harvest handling of fruits, especially peaches, and a limited supply of domestic temperate fruits other than Tan Hoa plums.

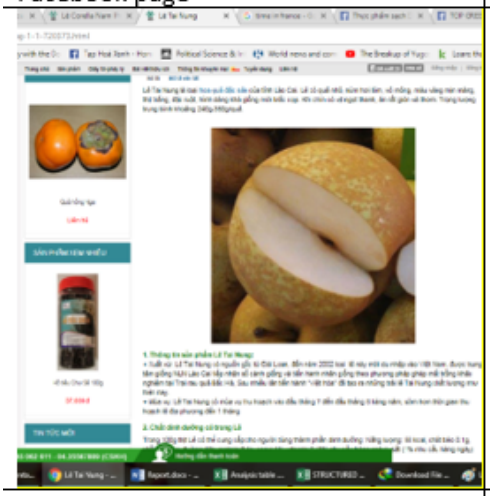
While most safe food retailers did not require any official certification from their suppliers, including VietGAP, Safe vegetable production, organic and geographic indication certificates, they developed their customers' perception that products are safe by communicating on social media: Zalo, Facebook and websites.

Retailers post detailed information about their products on social media, especially about the origin of products. (Picture 1 shows information about Lao Cai VH6 pear from several major safe food chain websites). They often use QR codes so customers can get information and pictures of production areas on their phones. This business model, which is based on promoting product origin, builds on consumers perceptions that Vietnamese products are safer than Chinese imports, and especially that the products from mountainous areas are not just safer but tastier and healthier. Our project team worked with several of these retailers, including the largest Bac Tom, which in 2017 grew to over 20 stores. When the chain was smaller and managed by the chain director, strong connections with suppliers and genuine relations with farmers were established, including training farmers in safe food production organised by Bac Tom. However, the franchise model was established for business to grow with only eight stores managed by original Bac Tom team and others independently managed by franchisees. Without any official

certification process to guarantee origin and safe production and post-harvest handling, it has been increasingly difficult for the franchise director to keep track of the business, with the growing risk of customers losing trust. With the number of businesses in this retail segment growing rapidly, it is a matter of time when one of the stakeholders will act unethically and be caught selling products with pesticide residues or imported from China, attracting negative publicity and jeopardising the whole industry.

Picture·1.·Information·about·VH6·pear·from·Lao·Cai·posted·on·Bac·Tom's·Facebook·page¤

Picture·2.·Information·about·VH6·pear·from·Lao·Cai·posted·on·Big·Green's·website¤



Picture·3.·Information·about·VH6·pear·from·Lao·Cai·posted·on·Donavi·website¤

Picture·4Information·about·VH6·pear·from·Lao·Cai·posted·on·Soi·Bien's·Facebook·page¤

Picture 1: Information about Lao Cai VH6 pear from several major safe food chain websites

7.3.4 Type of fruits, origins, suppliers and daily sale volumes

Figure 15: Number of retailers that sold plum, persimmon, pear and peach in 2016

In 2016, plums were the most common temperate fruit available in approximately 87% of interviewed retail businesses, while persimmon was sold in approximately 77% and pear in 60% of businesses. Peach was available in only 30% of total retail businesses (Fig 15).

Plum

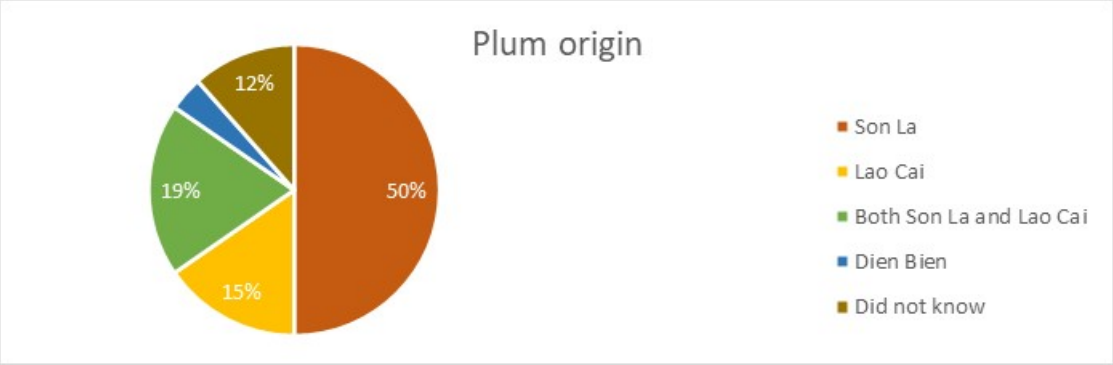


Figure 16: percentage of retailers sourcing plums from different provinces

In 2016, Tam Hoa was the main variety of plums, available in 25 out of 26 retailers that sold plums. In addition to Tam Hoa plum, two retailers, Bac Tom and Ecomart, also sold Ta Van variety (sourced from Bac Ha) but only in small quantity (less than 5kg per day). The only retailer who did not sell Tam Hoa plums sold an unknown variety from Dien Bien (CCM Dien Bien). None of these retailers sold imported plums.

Most retailers sourced Tam Hoa plum from suppliers based in the production areas. As a result, all of them knew the origin of their plums (Fig. 16). Around two-thirds of retailers sourced plums from Son La province (mostly from Moc Chau district), mainly from collectors, two directly from growers, and only one from the cooperative. Only seven retailers sourced plums from Bac Ha district in Lao Cai province, three from collectors, two directly from growers and one from a wholesaler.

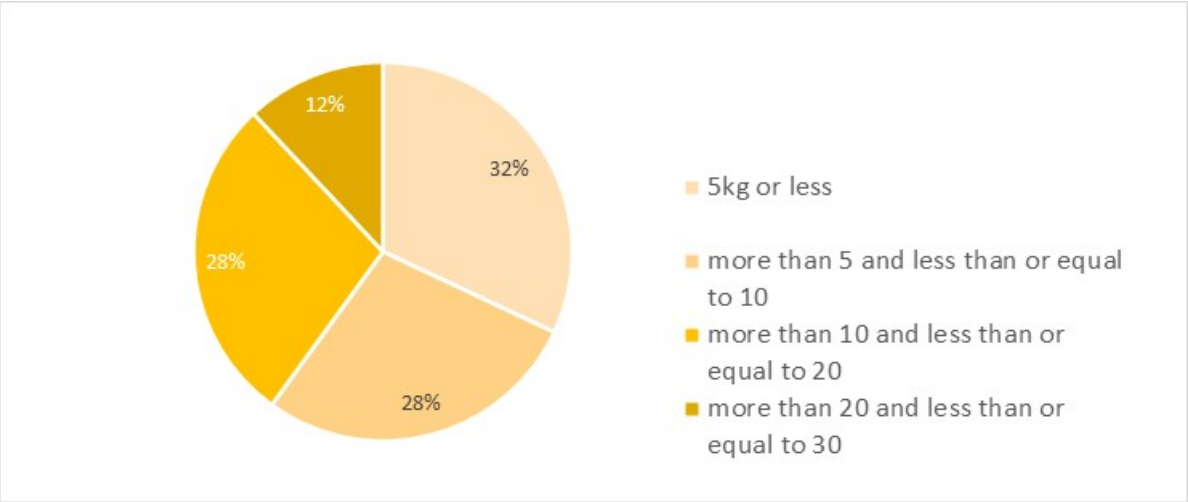


Figure17: daily sale volume of Tam Hoa plum per outlet

For nearly two-thirds of interviewed retailers, estimated daily sale volumes of Tam Hoa plum per outlet did not exceed 10kg per day (Fig 17). Only the largest chain Bac Tom with 20 outlets, sold more than 100 kg per day (between 100 and 150 kg), and only five chains sold between 50 and 100 kg/day. Most interviewees associated low plum sale volumes with competition from the traditional retail segment, as plums are widely available at traditional markets and street vendors at a lower price, 20,000-50,000 VND/kg, as opposed to 50,000-100,000 VND/kg in the safe food shops.

The aggregate estimated average daily sale volume for 26 retailers (85 outlets in total) was 587-697 kg. Assuming that their sale lasted throughout the whole harvest period of Tam Hoa plum (around 30 days), the total sale volume in the 2016 season would only be 17.6 – 20.9 t, which is very small compared to the total estimated volume of 3092 t of plum delivered to the traditional market segment in Hanoi.

Pear

Only 18 shops/chains sold pears in 2016. Ten of these shops sold pears produced in Vietnam, of which eight sold exclusively Vietnamese pears while two sold Vietnamese and Korean pears. Ten shops sold pear imported from Korea. Only one shop sold European pear (*Pyrus communis*) imported from South Africa.

Vietnamese pears mainly originated from Lao Cai province and some from Moc Chau. They were sourced from collectors (4 retailers) or producers, including individual growers, Bac Ha Seedling Station (owner of breeding rights for VH6 pear) and cooperatives. Imported pears were sourced from wholesalers in Hanoi.

Only two retailers sold more than 5 kg of pear per outlet per day, with only the Bac Tom chain selling more than 10 kg/day in total. Most interviewees attributed low sale volume to high prices. Korean pear is often priced at 150,000-200,000 VND/kg, and Vietnamese pear at around 70,000-80,000 VND/kg. Meanwhile, it was observed that traditional markets or street vendors sold Chinese pear for around 30,000VND/kg (for) and Korean pear for 60,000VND/kg.

Peach

Nine retailers sold peach in 2016, out of which six sourced peach from Son La, one from Lao Cai and one from both Lao Cai and Lai Chau province. Most retailers sourced peach from collectors. Only four retailers sold peaches every day during the April-May peach season, with a daily volume per outlet of only 2-5 kg. Bac Tom sold around 50-100 kg per day across its 20 outlets, while the other two retailers sold up to 10 kg/day

Persimmon

Among the four temperate fruits studied, persimmons have the most diverse origin. More than half of the retailers that sold persimmon in 2016 sourced this fruit from Son La province, mainly from Moc Chau. Collectors were the most common type of suppliers of persimmon with Son La origin (7), followed by cooperatives and growers. Some small retailers with one or two outlets also bought persimmon from wholesalers in Hanoi. Persimmon from other places, including Lao Cai (Bac Ha district), Lam Dong (Da Lat), Lang Son and Phu Tho, were only sold by one or two retailers and could be sourced from either collectors, growers or cooperatives. There was one retailer that sold persimmon imported from New Zealand.

Non-astringent persimmons were the most sold persimmon type, available at 18 out of 23 retailers. All of them sourced this product from Moc Chau district (Son La province). Other sources of non-astringent persimmon were Da Lat and New Zealand. Soaked persimmon was the second most common type, available at seven retailers. This type of persimmon came from Bac Ha, Lang Son, Tuyen Quang, Phu Tho or Da Lat. None except one retailer sold red persimmon, which was sourced from Da Lat.

In conclusion, all retailers sold persimmon with a crunchy texture, either non-astringent or soaked. Only one retailer offered red persimmon with a soft texture.

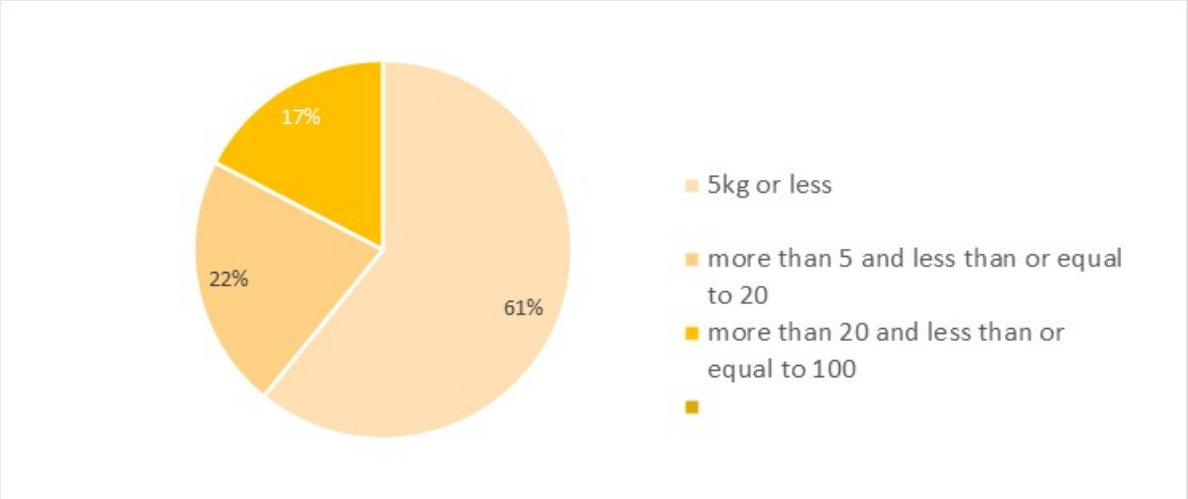


Figure 18: daily sale volume of persimmon per outlet

Since no interviewees could disaggregate persimmon sales, daily sale volume is estimated as aggregate sale volume of all persimmon types. Nearly two-thirds of outlets sold less than 5 kg/day, with six retailers only selling persimmon occasionally, not every day during the persimmon season (Fig 18). However, three retailers sold 50-100 kg/day more than any other temperate fruit.

7.3.5 Concluding remarks

The safe-food retail segment is quite small and fragmented. However, businesses in this segment are innovative and willing to sell fruit with a high price and low volume, making them suitable partners for introducing new fruit varieties into the market. As demonstrated for the newly developed Lao Cai VH6 pear, the segment can effectively promote the product and its origin through various channels, especially social media. Cooperation with this segment should also be considered for developing a regional branding for a range of products.

When the research was conducted, the safe food retail segment was rapidly expanding without any external or self-imposed regulations to make sure that claims of product origin

and “safety” were real. For the segment to sustainably develop, it is necessary to develop its own industry governing and accreditation body and follow the supermarket sector that promotes government fresh product accreditations, including VietGAP, safe vegetable production, and geographic indication (GI).

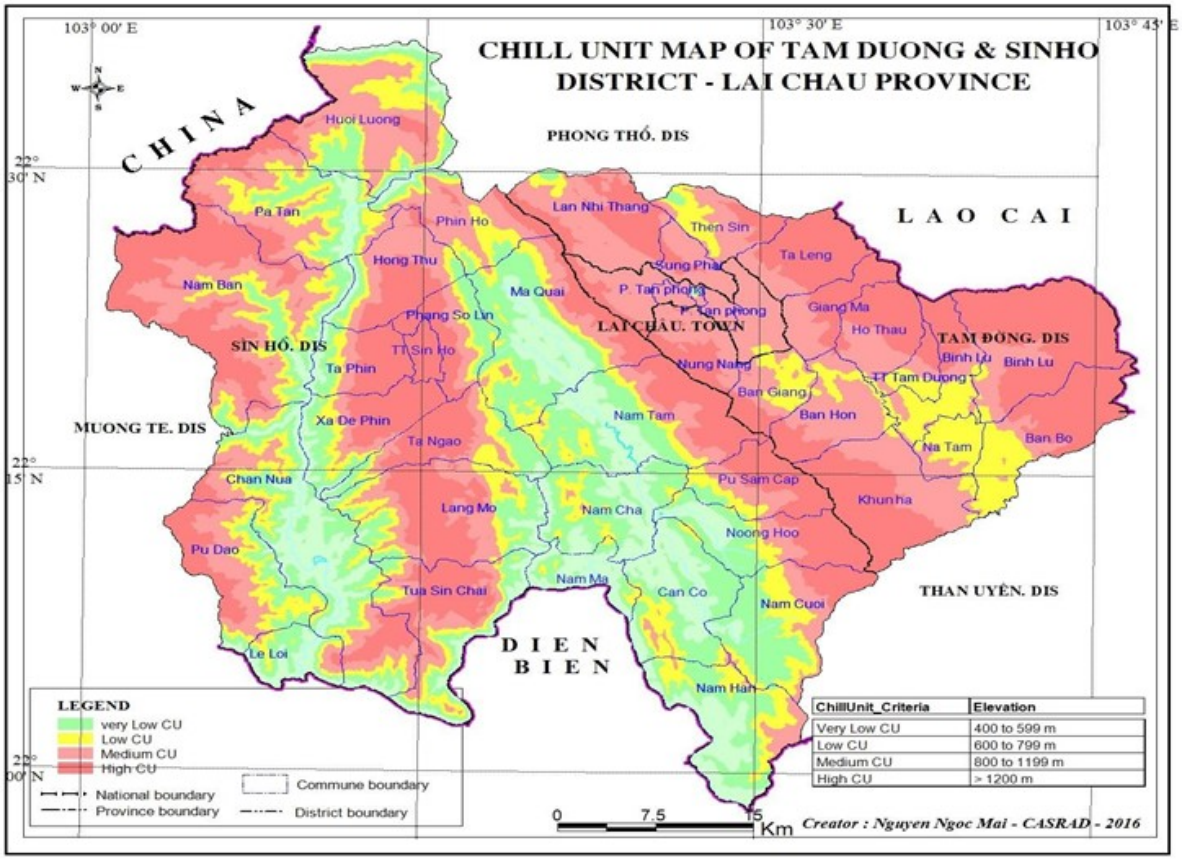
7.4 Production and trade of temperate fruit in NW Vietnam-Lai Chau, Lao Cai and Son La provinces

7.4.1 Overview of temperate fruit production

Lai Chau province

The current temperate fruit production is characterised by widespread but very small scale home garden cultivation of Hmong apple, Tam Hoa plum, local peach and apricot (*Prunus mume*), providing fruit for home consumption. In the last decade, the local government has been promoting and supporting the development of commercial production and planned to develop 200 ha of peach and VH6 pear by 2020.

To support these government development ambitions, our project developed a GIS map of Tam Duong and Sin Ho districts showing areas favourable for temperate fruit production based on adequate hours of cold weather necessary for initiation of fruit buds (chill units) (Map 1). Chill units (CU) were calculated using the George-Nissen model, taking into account the mean temperature of the coldest month (January in Vietnam). CUs were then correlated with altitude to predict CUs for a range of elevations.



Map 1: GIS map of Tam Doung and Sin Ho districts showing the distribution of chill units (CU)

The proportion of areas with low (< 250), medium (250-500) and high (>500) chill units for each commune in two districts was calculated.

All communes in Tam Đương district are suitable for the production of low chill stone fruit, and most communes can produce temperate fruit with medium chill requirements. The district was divided into three zones:

Zone 1: low altitude from 600 m to 799 m with low chill units comprising the following portion of land area (%) in each listed commune: Then Sin 29%, Bản Giang 26 %, Tam Đường town 43%, Bình Lư 14%, Na Tam 67%, Bản Bó 26%.

Zone 2: medium altitude from 800 m to 1199 m with medium chill units comprising the following portion of land area (%) in each listed commune: Bản Bó 11%, Bản Giang 23%, Bản Hon 59%, Bình Lư 17%, Giang Ma 41%, Hồ Thầu 36%, Khun Ha 33%, Lan Nhi Thang 49%, Na tam 29%, Nùng Nang 56%, Sung Phai 80%, Ta Leng 19%, Then Sin 43%, TT Tam Duong 23%.

Zone3: high altitude from 1200 m to 1600 m with high chill units comprising the following portion of land area (%) in each listed commune: Ban Giang 14%, Ban Hon 13%, Binh Lu 18%, Giang Ma 26%, Hồ Thâu 26%, Khun Ha 14%, Lan Nhi Thang 37%, Nung Nang 27%, Sung Phai 19%, Ta Lang 23%, The Sin 15%, Tam Duong town 12%.

Shin Ho district has a highly complicated and fragmented relief with many mountains and river basins. The level of chill units varies from very low to high in almost every commune. The district was divided into two zones:

Zone 1: Areas located in the two river basins: the first basin is bordered by Nam Mạ and Can Co rivers, and the second is bordered by the Lang Bong and Nam Co rivers. Both basins are at an altitude from 300 to 800 m having chill units below 250. This zone comprises the following portion of land area (%) of each listed commune: Can Co 40%, Chan Nua 39%, Hong Thu 15%, Huoi Luong 40%, Lang Mo 26%, Le Loi 32%, Ma Quai 45 %, Nam Ban 16%, Nam Cha 56%, Nam Cuoi 62%, Com Name 50%, Nam Han 28%, Nam Ma 32%, Nam Tam 34%, Noong Hoo 38%, Pa Tan 34%, Phang So Lin 34%, Phin Ho 33%, Pu Dao 34%, Pu Sam Cap 22%, Ta Ngao 35%, Ta Phin 21%, Tua Sin Chai 28%, Xa De Phin 32%.

Zone 2 is on sloping lands between 800 and 1600 m above sea level, comprising the following portion of land area (%) of each listed commune: Chan Nua 15%, Hong Thu 40%, Huoi Luong 26%, Lang Mo 44%, Ma Quai 24%, Nam Ban 55%, Nam Cuoi 14%, Nam Tam 21%, Noong Hoo 11%, Pa Tan 44%, Phang So Lin 46%, Phin Ho 57%, Pu Dao 43%, Pu Sam Cap 46%, Ta Ngao 40%, Ta Phin 11%, Tua Sin Chai 35% and Xa De Phin 13%.

The steepness of slopes limits the fruit trees cultivation in areas with suitable CU. The following guideline was provided for the suitability of the slopes for fruit production:

Slope percent	Options	Considerations
0-5%	Tree fruits,	drainage may be a problem, row or individual tree mounding beneficial, use grass swards between rows.
6-15%	Tree fruits	ideal, row or individual tree mounding beneficial, use grass swards between rows.
16-35%	Tree fruits	ideal, row or individual tree mounding beneficial, use grass swards between rows.
36-55%	Tree fruits	use of benches may be necessary, and use grass to stabilise the drops between benches is necessary.
56-85%	Forestry only	
>85%	Forestry only	

Despite the local government officials enthusiasm for the GIS map showing chill units, there is limited use of the map without overlaying it with other maps, including soil, roads and population density. Most of the areas with high chill units are on very steep slopes, without access roads and are scarcely populated, hence not suitable for large scale commercial production. Areas with medium and low chill units are much more suitable for commercial production, so the development of the temperate fruit industry will largely rely on low-chill stone fruits, Asian pear and persimmon.

The NOMAFSI project team also worked with the Lai Chau Extension Centre to establish 40 ha of VH6 pears and DCS1 peaches, which were initially successfully introduced to Gieng Ma commune in Tam Duong district by ACIAR project AGB/2008/002. The project team also facilitated cooperation between Lao Cai Plant Breeding Centre and the Lai Chau government to supply grafted seedlings for the expansion of fruit growing areas in Lai Chau.

Son La province

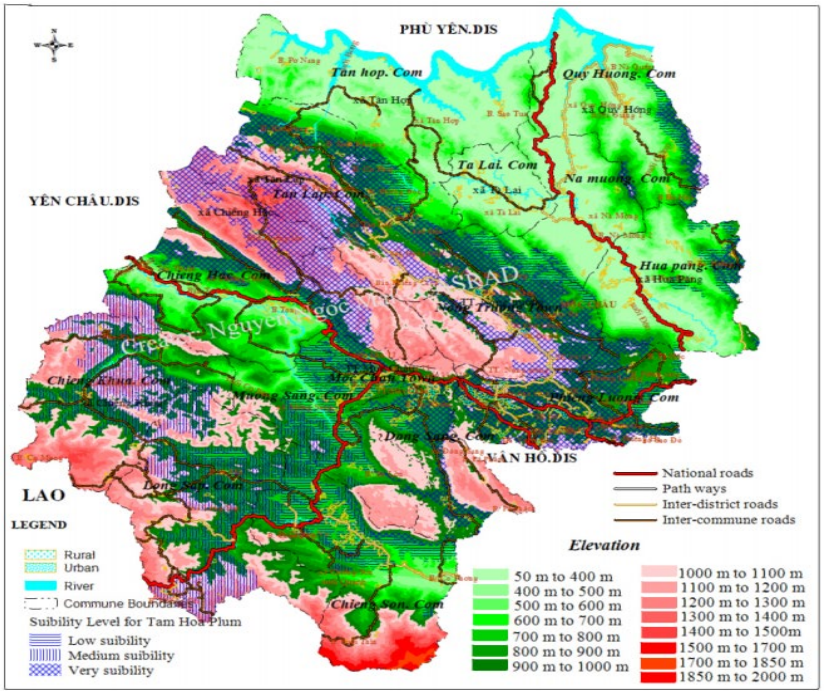
Son La, with 57,800 ha under fruit production, is the second largest fruit-producing province in Vietnam. The major fruit species are longan with 16,500 ha and mango with 15,000 ha, followed by plum (*Prunus salicina*) 9,800 ha, banana 5,000 ha, citrus 4,000 ha and passionfruit 2,300 ha. Plum is by far the most important temperate fruit species, followed by avocado and peach with1,000 ha each. Persimmon with 143 ha and Asiatic pear 42 ha are minor but potentially important fruit species. Hmong apple (Son Tra) grown on 12,100 ha is another important fruit, but the Vietnamese Bureau of Statistics classifies it as an agroforestry species.

Moc Chau district is largely situated on a plateau at an elevation between 800 and 1300 m above sea level, and with 200-600 chill units (CU), it is the most suitable district for temperate fruit production in Son La province. A GIS map (Map 2) showing CU overlayed with soil characteristics shows the suitable areas for temperate fruit production (purple colour).

High suitability areas are located in the middle of Mộc Châu district at an elevation of 800m - 1300m and with 400-600 CU. This climate area is cool, with an average temperature between 15-20^{o} C. The cold season lasts about 4 - 7 months and there are medium to high precipitation rates between 1500 - 2500 mm/year. The high suitability areas include Tân Lập Commune, Nông Trường town (villages at high elevation including Pa Khen village), Phiềng Luông commune, Mộc Châu town (only villages with high elevation), Mường Sang commune (Nà Bó village), Chiềng Hắc commune (Tà Số and Phiềng Lán villages) and Đông Sang commune (Pá Phách, Chăm Cháy, Sung and Cóc villages).

Medium suitability areas are located at similar elevations with 400-600 CU, but these areas have lower precipitation with less than 1500 mm/year. These areas include Mường Sang (villages at higher altitude), Chiềng Sơn, Lóng Sập, Khiềng Khừa and Chiềng Hắc communes.

Low suitability areas are located in zones between 600m - 800m above the sea level and chill factor of less than 400 CU. These areas include Mường Sang (Bãi Sậy, Lùn, TK 2, Thái Hung, and Sò Luon villages), Tân Lập (Đội 12, Phiềng Đón and Nóng Cóc villages), Chiềng Hắc (Tòng Hán village), Chiềng Sơn (Lò Lang, TK 10, TK1, TK3, TK4, TK2, TK 6, TK 30/4, TK 3/2 and Chiềng Ve villages), Phiềng Luông communes (Tám Ba village), parts of Nông Trường town (parts of Tà Lọng and Bản Ôn villages at lower altitude) and Mộc Châu town (TK14).



Map 2: GIS map of Moc Chau district, Son La province, showing the distribution of chill units (CU)

The areas with low suitability would be suitable to produce unripened processing quality plums for export to China, which at the time of project implementation (2015-2017) brought higher income to smallholders than most broadacre crops, including maize. Areas with medium suitability can be planted with plums for processing and fresh sale at traditional markets. Farmers in prime areas could focus on producing high quality plums for modern retailers in urban markets.

The map can also be used to determine suitability for the production of other temperate fruits. However, the small size and accessibility of areas with more than 250 CU are limiting factors for the introduction of medium and high chill varieties on a commercial scale. Local government and private nurseries were only interested in low chill stonefruit varieties, avocados, Asian pears and persimmons that can be grown at scale in Moc Chau and other districts.

Lao Cai province

Lao Cai has several districts, including Bac Ha, Sa Pa, Si Ma Cai, Bat Xat and Muong Khuong, situated on high elevations above 1000 m having a cool climate with CU from 250-550. These districts are suitable for temperate fruit production, making Lao Cai renown for its diverse temperate fruit production. Lao Cai was the province where Tam Hoa plums were initially introduced from China before spreading across NW Vietnam in the 1980s, and currently, Lao Cai is pioneering VH6 pear production (see section 7.4.3). Tam Hoa plum has been by far the most important fruit variety, with production peaking in 2003 when plums were grown on 1,800 ha. Since then, there has been a sharp decline in production, with only 770 ha planted with plums in 2014 when the project started (Fig 19).

While the cultivation area of plums decreased, the cultivation of pears increased significantly to 500 ha from 20 ha in 2003, and cultivation areas of peach and persimmon doubled in the same period to 360 ha and 260 ha, respectively. In 2014 Lao Cai province produced 2,700 t of plum, 800 t peach, 630 t persimmon, 420 t pear and 250 t apricot (*Prunus mume*).

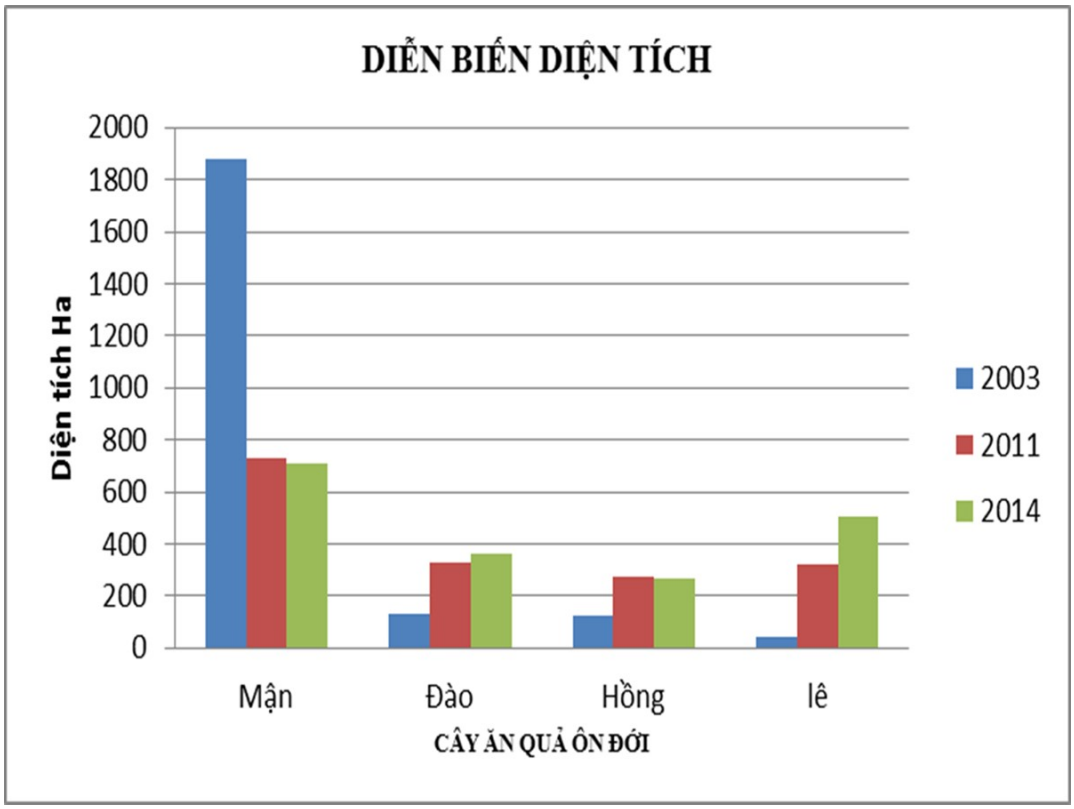


Figure 19: Cultivation area (ha) of plum (man), peach (dao), persimmon (hong) and pear (le) in Lao Cai province in 2003, 2011 and 2014.

Lao Cai provincial government has plans to expand current production of temperate fruits to 3000 ha by 2030, mainly by increasing pear and, to a lesser extent, peach production. During project implementation, there were several ongoing projects to improve plum production by pruning and fertilising old orchards and starting new orchards to replace the old ones. More details on plum and pear production is presented in sections 7.4.2 and 7.4.3.

7.4.2 Plum production and trade in Son La and Lao Cai provinces

Plum in Son La province

As a result of several good plum seasons in the mid-2010s and government support for fruit production development, the planting area of plums in Son La province increased threefold in the period 2015 to 2019 from 2,965 ha to 9,800 ha (Fig 20), with production doubling in the same period from 28,000 to 59,000 t. Major production districts were Moc Chau (2,800 ha), Yen Chau (2,400 ha), and Son La city (2,200 ha). Even though the local government supports the expansion of fruit production to reduce areas planted with maize, the government focused on longan, mango and Son Tra, for which the government-run nursery provided free planting material. The expansion of Tam Hoa plum was mainly driven by farmers who produced planting material using marcotting.

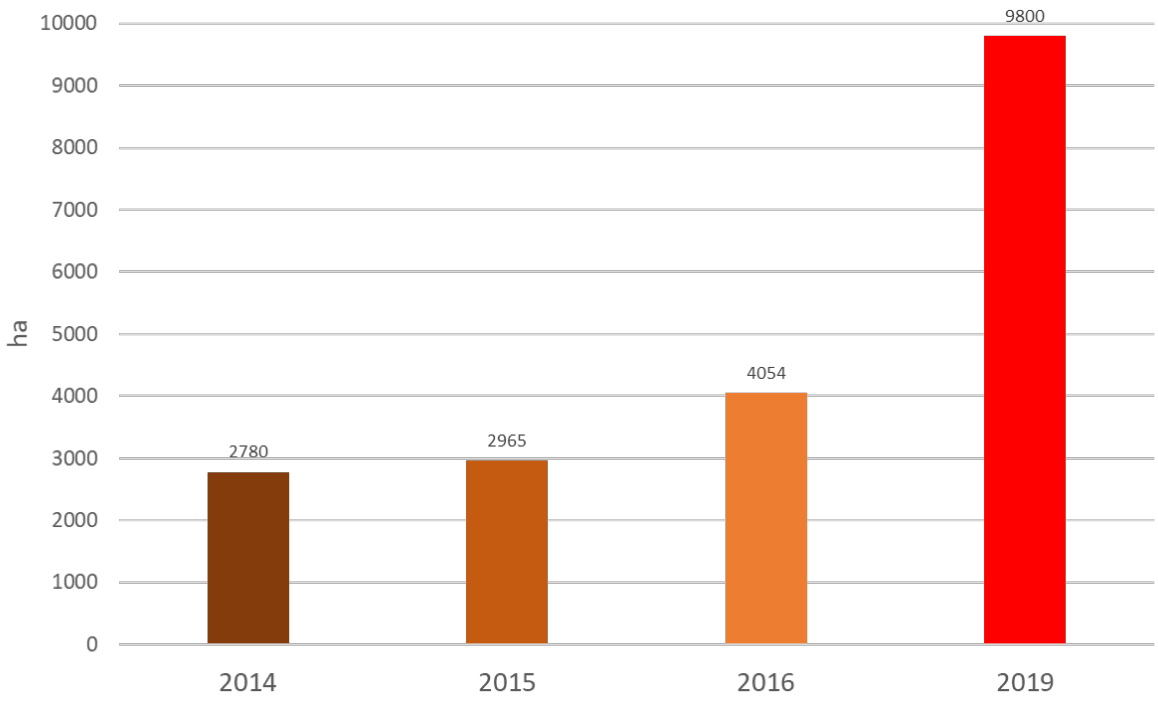


Figure 20: Cultivation area (ha) of plum in Son La province from 2014 to 2019

In 2015 a survey of 150 households was conducted in Moc Chau district communes of Chiềng Sơn, TT. Mộc Châu, TT Nông trường Mộc Châu, Phiêng Luông and Tân Lập, and van Ho district communes of Vân Hồ and Lóng Luông. Farmers were randomly selected from the villages with extensive plum production. The only criteria for the selection of farmers was that they had some plum trees. Surveyed plum growers came from many ethnic groups, including King, H'Mong, Tay, Nung, Phu La, Dao, Muong, Hoa and Thai.

The survey results showed that, on average, households (HH) grow plums on 1 ha (sd=0.09) with an average of 277 (sd=209) trees/HH. On average, households produce 2.95 t (sd=2.42t) of green plums and 7.25 t (sd=8.16 t) of ripened plums. High standard deviations indicate a huge variation in the number of trees grown and fruit produced between households. Many households grow plums scattered in the hills using pockets of fertile land resulting in very low density per hectare. Sometimes plums are intercropped with maize and fodder grasses, and in some areas, plums and tea are grown together, resulting in a very low number of plum trees per hectare. However, in major production locations, including Pha Khem, Na Ka valley, Co Do and Ban On, plums are grown in large areas on gentle slopes or valley's flats with a density of 400 to 600 trees/ha with high production volume and income. In Moc Chau, 32% of trees were ≤ 4 years old, 39% were 5-15 years old, and 29% > 15 years old. The majority of planting material was produced by farmers using marcotting, with only 26% of seedlings coming from nurseries. Nearly all farmers used some fertiliser (≈90%), and insecticide (≈80% mainly for aphids), but only 25% of farmers used fungicide, and around 50% used herbicide. It should be noted that the survey was based on random sampling capturing a range of farmers who grow plums, and for many of them, plums were a small part of their farming system, providing additional income. They do not invest in plums and tend to put some fertiliser only after a good harvest and occasional pesticide spray only when they expect a good harvest. Other than removing a few dead branches, these farmers don't prune their trees. None of the farmers practised the thining of the fruits. There are 10-20% of farmers that focus on plum production as the main source of income, and they use fertilisers, manage pests and diseases and prune their trees.

The results of the 2015 household survey also showed that income from plum production in areas categorised as suitable in GIS map (Map 2): Tan Lap commune and NT Moc Chau was three-time higher than income from maize (90 million VND/ha vs 30 million for

maize) and in villages categorised as very suitable for plum production including Pha Khem, Na Ka valley, Co Do and Ban On income was four to five times higher. Plums outperformed maize even in the areas with low suitability, where farmers sold unripened (green) plums for export to China. However, it should be noted that Tam Hoa plums have bi-annual fruit-bearing, with a high yielding year being followed by a lower yielding year, and the 2015 survey reflects a high yielding year.

Description of plum supply chains originated in Moc Chau district

Classification of supply chain actors

Supply chain actors were classified as collectors, collecting agents, assembly traders, agents of assembly traders at the wholesale market (Long Bien in Hanoi) and wholesalers.

Collectors are based in the production areas and purchase plums from farmers. They take ownership of the product and sell them to assembly traders in Moc Chau or wholesalers in Moc Chau or other provinces and cities; sometimes, they sell directly to retailers in Moc Chau and other provinces or cities. In Moc Chau, there are at least 40 plum collectors trading approximately 6,000 t of green and ripe plums, graded and ungraded.

Collecting agents are based in the production areas. They acquire products from farmers on behalf of assembly traders for a fee (they usually receive money from assembly traders in advance). They don't take ownership of the product. There are around 100 collecting agents collecting approximately 9,000 t of green and ripe plums.

Assembly traders operate in the production area. They mainly source plums through collecting agents or purchase plums from collectors. Sometimes they buy plums directly from big farmers. They take ownership of the products and sell plums to wholesalers in other provinces and cities or to Chinese traders in the Lang Son border area. In 2016 approximately ten assembly traders were handling around 13,000 t of plums, of which 6,000 t are exported green, and 1680 t ripened to China, 4,000 t ripe plums were sent to Hanoi and around 2,200 t to Ho Chi Minh City.

Agents of assembly traders at Long Bien market. They often have space near the entrance of the market and provide a storage and distribution service. They don't take ownership of the products, and they don't take the risk for unsold goods. They distribute plums to wholesalers in Long Bien and to wholesalers from other provinces/cities. Importantly, they handle payments from wholesalers and take commission before they pass money to assembly traders. There are around five agents at Long Bien market handling around 4,000 t of plum in 2016.

Wholesalers operate in wholesale markets (e.g. Long Bien), and they usually make transactions with assembly traders through agents in the wholesale market. Often they buy ungraded plums and perform grading themselves. They then sell plums to retailers (wet markets, traditional shops, street vendors) and wholesalers from other provinces/cities. In 2016, approximately 15-20 plum wholesalers in the Long Bien market traded around 3,000 t of plums.

The major supply chains originated from Moc Chau

In 2016 four major supply chains originated from Moc Chau: ripe plum chain to wholesale markets in Hanoi and Northern provinces accounting for 4,000 t, ripe plum chain to Ho Chi Minh City and Southern and Central Vietnam (with small quantities exported to Cambodia) with 2,200 t of ripened plum exported to China mainly to Na Ning, Guangxi province with a volume of approximately 2,000 t, and unripe (green) plum chain to Pu Ning, Guangdong province with approximately 6,000 t exported (Fig 21).

Assembly traders play a leading role in organising and financing all these supply chains. They organise the collecting of plums from farmers through collecting agents, for whom

they provide finance, and collectors, from whom they buy plums. Ripe plums are usually roughly graded with higher quality exported to China and sent to the Hanoi market, and slightly lower quality sent to HCMC. The lower quality plums are sent to HCMC because traders paid a lower farmgate price for them, which compensates for higher transportation costs so that wholesale prices in Hanoi and HCMC are similar. Traders believe that if first-class plums are sent to HCMC, the retail price would be too high for the average consumer shopping at wet markets.

Plums sent to China and HCMC are packed in smaller 15 kg boxes, and plums sent to Hanoi in larger boxes of 25 kg or more. Most boxes used for ripe plums exported to China have proper Chinese signage, stating Tam Hoa plums from Moc Chau. Green plums are exported in second-hand boxes containing 40 kg or more.

After grading and packing, the assembly traders organise large shipments of plums to Lang Son border area if plums are exported to China or to wholesale markets in major consumption centres, including Hanoi, Da Nang and Ho Chi Minh City (Map3). They own and hire semitrailers loading up to 45 t of plums at a time. Most assembly traders are locals, but some come from other provinces during the plum season. There are no written contracts between actors; exchange is based on trust, and there are financial risks along the chain. Several times assembly traders from other provinces disappeared without paying collectors. Farmers are, however, paid by collectors at the time of delivery of their plums.

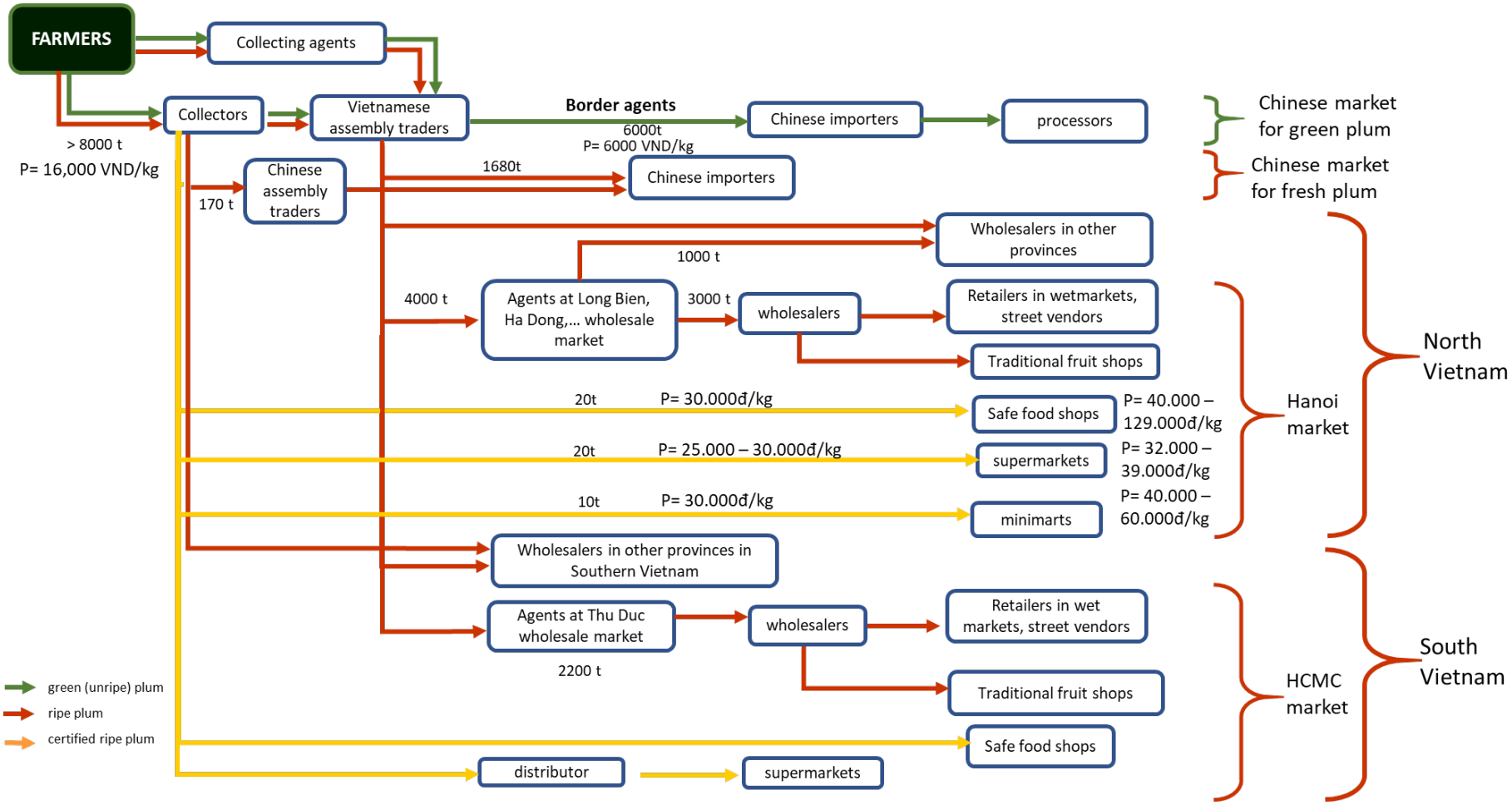


Figure 21: Distribution map of plums traded from Moc Chau district in 2016

Map 3: Plum trade from Moc Chau to other parts of Vietnam

Most plums in HCMC are handled at Thu Duc wholesale market and in Ha Noi at Long Bien. At Long Bien market, the assembly traders operate through agents who have space near the market entrance and provide storage and distribution services. The agents also handle payments between wholesalers and assembly traders without taking ownership of the products. Wholesalers grade plums into two categories mainly based on size with large plums with a diameter of 3.5 to 4 cm fetching up to 50% higher price (45,000 VND/kg) than smaller plums (30,000 VND/kg) mid-season. However, the difference in price is less at the beginning and the end of the season.

The project team conducted additional research to better understand exports to China and the supply to “modern” markets, including supermarkets, safe food shops and minimarts.

Supply chains to China

The development of unripe plum exports from Moc Chau to China that started at scale in 2008 fundamentally changed the market landscape and had a significant positive impact on farm-gate prices. The fast growth of green (unripened) plum exports happened because Tam Hoa plum variety, dominant in Moc Chau, is preferred by Chinese processors and ripens two to three weeks earlier than plums in Chinese production areas. In addition, it is not hard for Vietnamese exporters to comply with processors’ requirements: small fruit (in most cases 60 or more fruit per kg), degree of ripening at about 70% with hard flesh and colour that is just starting to change from green to yellow and red, and no cracks or bruises.

At least eight large exporters (assembly traders) in Son La buy unripe plums from collectors in production areas and then ship them from Son La to Lang Son-Guangxi border area in large 30-40 t trucks (Fig 22). At the border, exporters have relations with one or two bilingual border commission agents (Ta Xich), whose role is to connect Vietnamese exporters with buyers in China, negotiate selling prices, and collect payments. Approximately ten large

Chinese traders based in Guangxi or Guangdong provinces are importing the plums at the Lang Son border. The fruit is reloaded from large Vietnamese trucks onto 5 t Chinese trucks, then taken to a nearby logistical centre, and then loaded again onto large Chinese trucks for transportation to Pu Ning in Guangdong province, some 1,300 km away from Son La (Map 4). Repeated loading and unloading enables importers to circumvent taxes and fees applied to consignments over RMB 8,000 but has a negative impact on fruit quality.

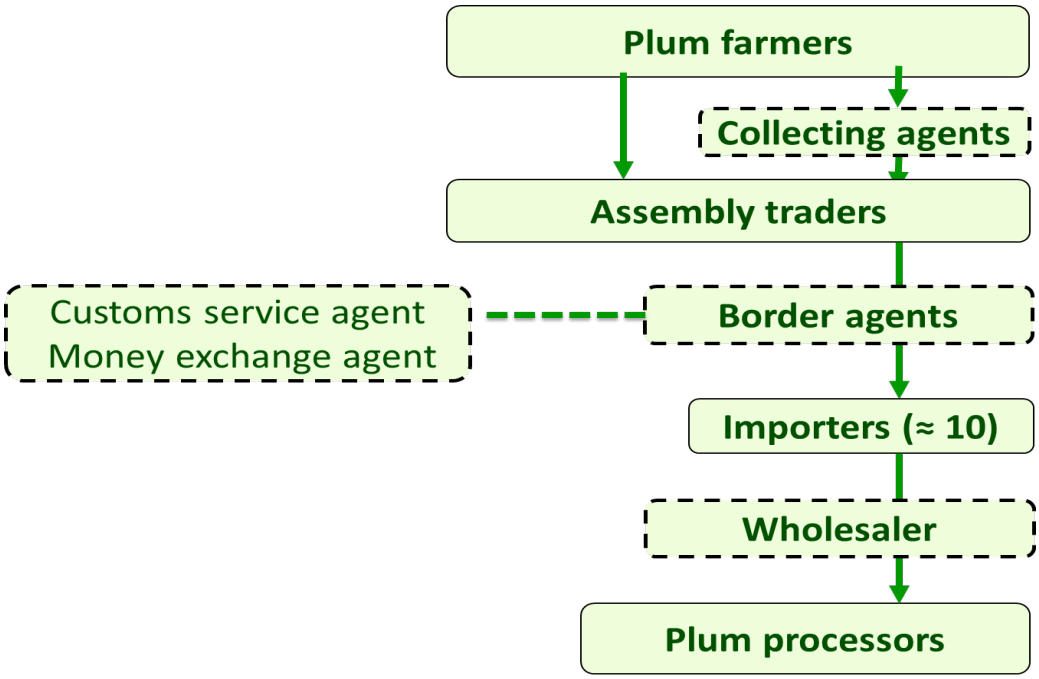
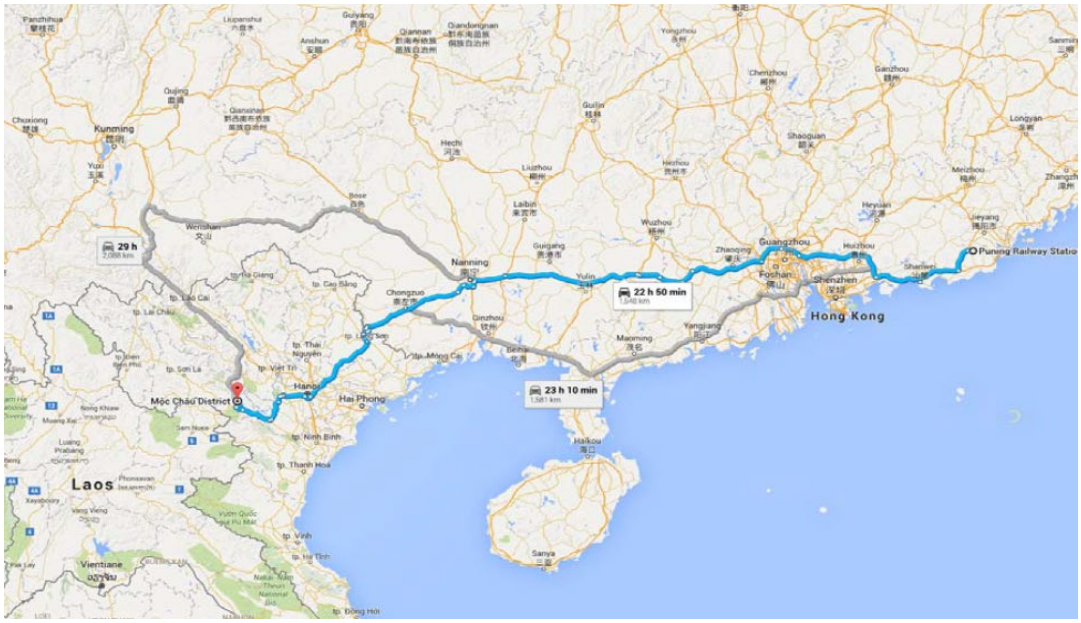


Figure 22: Green plums supply chain for processing in China

Pu Ning district, with around 100 processing facilities, is the main plum-processing centre in China. Approximately 60,000 t of plums (*Prunus salicina*) are processed annually within the district, two to three times more than the total harvest volume in Vietnam.



Map 4: The long journey of Moc Chau plums for processing in Pu Ning district, Guang Dong Province

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The processing of plums is organised in two distinct phases: salting and drying (Pic 2), with salted plums being traded as raw material for the second phase (Pic 3), in which aroma and colourings are added. Usually, sugar is added except when the final product is savoury plums

Basins for salting (30 m³) 75-80 kg of plums + 25-20 kg of salt

Drying after 3 months of salting (approximately for 5 days)

Dried salted plums (semi-processed plums)

Picture 2: The first step of processing: salting and drying of plums. Salted plums may be the final product or raw material for the production of sweetening plums.

Flavours being added to plums

Nearly-finished products (drying chamber)

Final product (individually packed for domestic market)

Picture 3: The second step adding sugar and flavours.

In 2017 processors faced a number of challenges, with fresh fruit prices rising faster than processed fruit prices and more restrictive government regulation on the use of flavouring and colouring additives that forced the industry to use more expensive natural products, further reducing their profit margin. In addition, the Chinese government implemented strict environmental protection regulation forcing the closure of many smaller processing plants. These developments could negatively impact Vietnamese export by reducing demand for Vietnamese plums, but at the same time, they represent an opportunity since Chinese processors are now more interested in importing salted and dried plums from Vietnam to manage raw material costs.

The unripe plum export is particularly advantageous to poor farmers, as it provides a marketing avenue for low-quality fruit. It is estimated that around 3,000 plum farm households in Son La province, many from ethnic minorities, have seen their wellbeing improve as a result.

There is a real opportunity to specialise in unripe plum production by redesigning orchards to increase planting density and crop load and increase efficiency and profitability of production. Coupled with that, the development of a processing industry primarily oriented towards the production of semi-processed plum for initial export to China and then eventually to Taiwan and Japan, could further increase demand and positively impact farm-gate prices and employment.

Supply chains to modern markets

Local collectors, not assembly traders, sell plums to modern retailers, including supermarkets, “safe food shops”, and minimarts (Fig 23) with whom they have built a stable relationship. Volume sold through these outlets is so small that in 2017 only two collectors supported by the project delivered 41.8 t, approximately 80% of the total volume sold by modern retailers in Hanoi. However, this was a significant increase from 23 t sold by the same collectors in 2016. The number of retail chains serviced increased from 10 in 2016 to 12 in 2017, while average sales per retailer increased from 2.3 tons to 3.8 t.

Sales were unequally distributed between retailers in 2017, with supermarkets Fivimart accounting for 45% and Vinmart 14% of the volume of plums sourced from the two collectors. One collector who focussed largely on these two supermarket chains supplied 72% of the total volume. His sales to modern retailers expanded by 162%. The other collector concentrated on smaller safe food retail chains (see Section 7.3). He experienced an increase of just 11%.

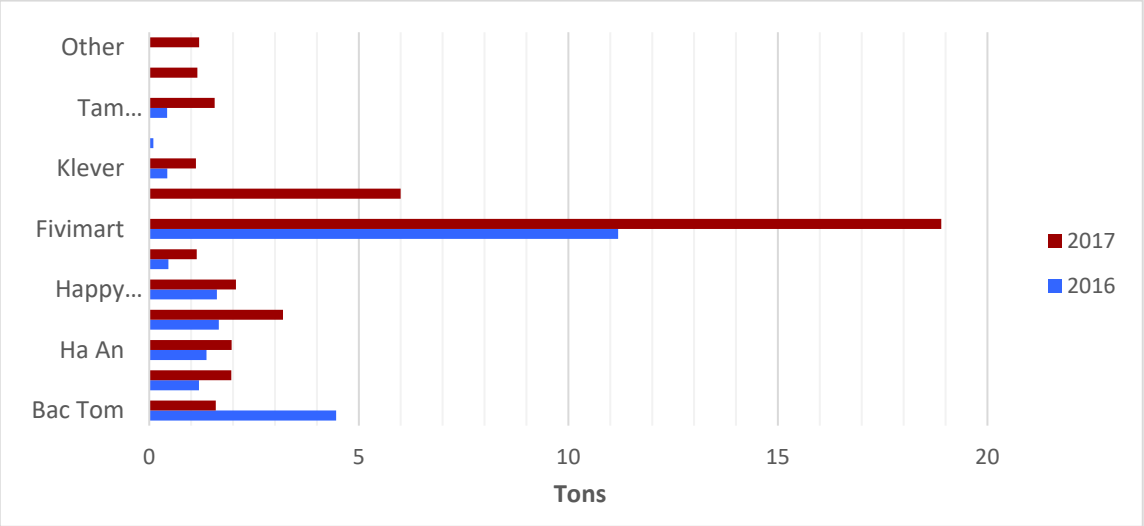


Figure 23: Plum sales by two collectors in Moc Chau to modern retailers in Hanoi in 2016 and 2017

Retailers pursued very different marketing and food safety strategies. Klever Fruit, a retailer specialising in high value imported fruit mainly from the USA, Canada, and Australia, stood out from all the other retailers. Their plums were significantly larger (42.18 mm diameter) and sweeter (13.3 Brix). These plums retailed for two to four times the price set in the other outlets. Moc Chau plums were the only Vietnamese product sold by this retailer. At the other end of the spectrum, Fivimart prioritised cost-competitiveness and sales volume, offering the smallest (36.32 mm diameter) and less sweet (12.5 Brix) but most affordable (40-60,000 VND/kg) plums.

Most retailers keep prices nearly constant (Fig 24) despite the large fluctuation of wholesale prices during the plum season (Section 7.2.2). Prices in 2017 were significantly higher than in 2016, with an increase been above variation in wholesale prices between 2016 and 2017.

While most smaller retailers relied on trust to guarantee the safety of products, larger retailers like Fivimart requested food safety certification while Vinmart conducted their own testing in the orchard and had a representative present at harvest time.

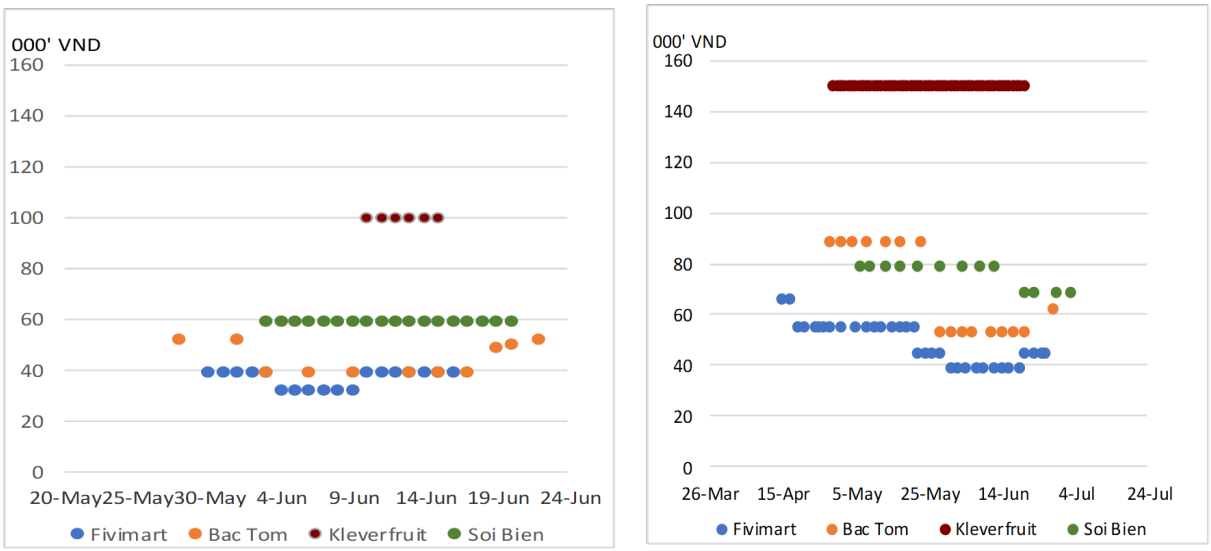


Figure 24: Price of Moc Chau plums from some participating retailers for 2016 (left) and 2017(right).

The two collectors sourced plums from 15 farmers. Although supplies for the modern retail channel represented a very small share of their harvest, farmers received relatively high premiums 30-100% (Fig 25), but premiums varied significantly during the season and dropped to as little as 10% when the farmgate prices for ungraded plums for wholesale markets were high. Many farmers withdrew from the modern retail channel at the time the premium was low.

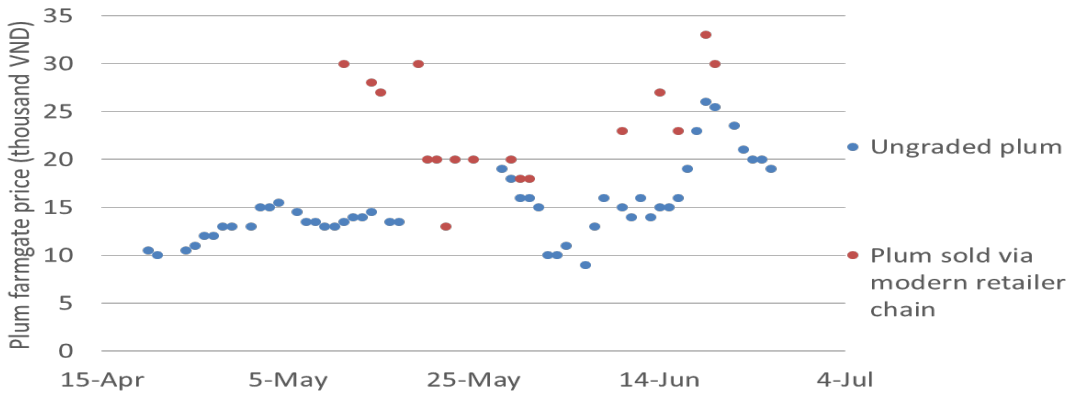


Figure 25: Farmgate price paid for graded premium plums for the modern retail market and “all in one” grade in 2016.

In 2017, transactions between the two collectors and modern retailers represented less than 0.2% of the Son La harvest. Thus, while direct income impacts will remain relatively modest over the foreseeable future, there is much scope for growth. However, other impacts of Moc Chau plum presence in modern retailers should also be considered. Tam Hoa plums in modern retail outlets are changing the perception of local plums as a low-status fruit, which may lead to increased consumer demand. The fact that Klever Fruits (Pic 4), a very exclusive fruit retailer, has added Moc Chau plum to a portfolio that consisted exclusively of imported fruits is noteworthy. The status of plums has also been assisted by strong tourist promotion, whereby plum orchards together with tea gardens represent a major attraction in Moc Chau. In 2017 the plum harvest festival attracted more than 7,000 visitors to the district and received a high level of media coverage.

Picture 4: Klever Fruits, the retailer specialising in imported fruits, included Tam Hoa plums in their portfolio, elevating the status of the plums across all market segments

The growing involvement of modern retailers should also result in a more enabling technical- and quality-upgrading environment. This could have a spillover effect on plum farmers supplying traditional market segments, while quality assurance systems or product branding strategies developed for plums may be applied to other smallholder farm products.

Market segments and their major characteristics

Based on the market and value chain research presented above, the team identified seven market segments (Table 1). In 2016, there were two export market segments to China, one for unripened plums for processing, which was the largest of all seven segments, but this segment is mature and most likely to be stagnant or decline in the future. The other is a growing segment for ripened plums with potential growth. Both export chains were not officially recognised export channels, and there is a high risk that China will regulate the import of plums which can negatively impact export volumes. The other factor impacting export is annual weather variations causing, in some years, later harvest in Vietnam and earlier harvest in China, reducing the market share for Vietnamese plum in China.

There are two traditional market segments in Vietnam: 1. Hanoi and the Red River Delta, and 2. Ho Chi Minh City and the Mekong Delta. In 2016, the Hanoi market was double the size of the Ho Chi Minh market, but the latter was still in the growing phase while the former was mature and stagnant. The Hanoi market required higher quality plums, while the Ho Chi Minh market was supplied with a lower grade, smaller plums. The last three are modern retail segments, including safe food retailers, supermarkets and mini-markets/convenience stores. All three segments were very small, but they experienced fast growth and were important for recognising Vietnamese plums as fashionable fruit for the emerging urban middle class.

Table 1: Market segments and their major characteristics

Market segments	Farm-gate price	Market size	Stage of life cycle	Risk			Customers' preferences	Absorption potential + price response to increased supply
				Competition	Legislation/ political	Seasonality		
Chinese market for green plum	6,000-7,000 VND/kg	6000 t	Mature	-apricots (*Prunus mume*) -Chinese plum (depends on seasonality)	-China close the border -Stricter environmental requirements in China	Late harvest in Vietnam or early harvest in China	- preferred: fully unripen plum - can accept damaged plums	**further study is needed**
Chinese market for ripe plum	14,000 - 16,000 VND/kg	2000 t	Growth	-Chinese Tam Hoa plum (depends on seasonality)	-China close the border/tighten food requirements	Late harvest in Vietnam or early harvest in China	-medium quality	
Hanoi traditional market segment	14,000 -20,000	3000-4000 t	Mature Stagnant	-Chinese Tam Hoa plum (but very weak)	-urban planning -Safe-food regulations extended to tradition market (low)	Short harvest period with concentrated volume	vary from low quality (small) to high quality (big)	
HCMC traditional market	12,000-14,000 VND/kg	2000 t	Maturing still growing	-none	-Regulations on safe food sale extended to tradition market (low)	Short harvest period with concentrated volume	Low to medium quality plum (small)	

Table 1 (continue): Market segments and their major characteristics

Market segments	Farmgate price	Market size	Stage of life cycle	Risk			Customers' preferences	Absorption potential and price response to increased supply
				Competition	Legislation/ political	Seasonality		
Safe food retailers	20,000-27,000 VND/kg	20 tons	Growth	Bac Ha plum	Tightened regulations on safe food sale	No	Certified plums with big and uniform size	**further study is needed**
Supermarkets	20,000-27,000 VND/kg	20 tons	Growth	None	Tightened regulations on safe food sale	No	Certified plums Size does not need to be big	
Minimarkets (Vinmart)	20,000-27,000 VND/kg	6 tons	Growing	None	Tightened regulations on safe food sale	No	Plums tested by themselves	

Plums in Lao Cai province

Even though Lao Cai is well known for the production of “Bac Ha plums”, the popular name for Tam Hoa plums grown in Bac Ha district where climate and soil enable plums to reach their highest quality potential, plum production in Lao Cai province contracted from approximately 1,900 ha in the early 2000s to just 700 ha at the time of the inception of our project in 2014. The growing area remained stable in the next five years, with efforts concentrated on rejuvenation and improved management of existing orchards. The stagnation and even reduction of plum production was also recorded in Moc Chau in the early 2000s, but then the production stabilised and gradually increased with the development of the plum export to China in 2008. Our results indicate that a cooler climate in Bac Ha results in plums ripening 2-3 weeks later than in Moc Chau, at the same time as the plum season starts in China and the lychee season starts in Vietnam. This difference in seasonality has a twofold effect: Chinese importers are not interested in Bac Ha plums, and Bac Ha plums compete with Chinese plums and lychee in the domestic market, limiting market size for Bac Ha plums to 3-4,000 t.

In 2015, the project team surveyed 75 randomly selected households from Bac Ha district communes of Na Hối, Tà Chải and Bắc Hà. The results showed that on average, HH grows 90 plums trees on 0.2 ha producing approximately 0.5 t and generating an income of 10,000,000 VND. Farmers sell more than 70% of production at the local retail market, and just over 20% of production is sold through traders, mainly within Lao Cai province.

Farmers, of which 68% belong to Tay and 25% to Nung ethnic minorities, have limited knowledge and skills in plum production, resulting in observed low productivity, which is partly offset by high price on the local market (25-35,000 VND), so farmers still earn a significant portion of their income from plum production. The local government tried to increase production by giving farmers good quality grafted seedlings produced in Bac Ha nursery for free. However, most grafted seedlings died because farmers were accustomed to more vigorous marcotted planting material and did not have the knowledge and skills to cultivate grafted seedlings. A lack of government funds to support the establishment of orchards jeopardised the investment in quality grafted seedlings and did not just stall the development of the plum industry but also compromised farmers’ trust in government nurseries because farmers wrongly attributed the poor establishment of orchards to low-quality seedlings and not to poor post-planting care.

7.4.3 Pear production in Lao Cai province

Lao Cai province is the largest producer of Asian pear (*Pyrus pyrifolia*) in Vietnam, with a cultivation area of nearly 700 ha, of which 200 ha were harvested in 2017, producing 550 t of fruit (Fig 26).

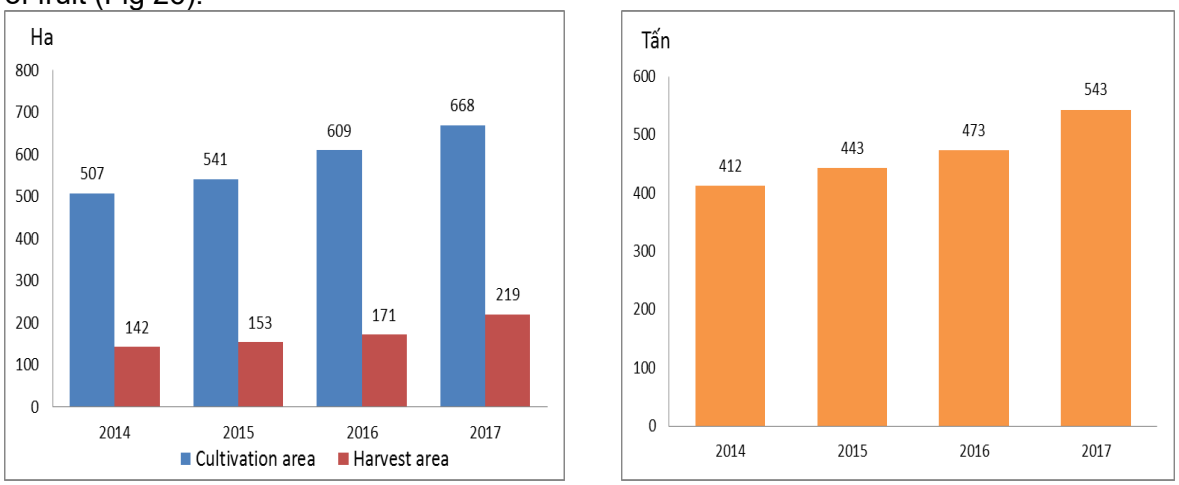


Figure 26: Pear production in Lao Cai province area (ha) left and volume (t) right in the period between 2014 and 2017

The development of the pear industry is based on a variety VH6, which originated from Taiwan and was commercialised by the main provincial government nursery in Bac Ha (Pic 5). The provincial government has been providing free or subsidised grafted seedlings to farmers together with training and technical support, aiming to reach a planned production target of 4,500 t of pear by 2025. Major production areas are in mountainous districts of Si Ma Cai, Sa Pa and Bac Ha.

Picture 5: Bac Ha station introduced VH6 pear to Lao Cai and has breeders rights

In 2018 a survey of 70 households growing pear was conducted, with 30 HHs in Bac Ha, 26 HHs in Si Ma Cai and 14HHs in Sa Pa districts. Unlike the survey of plum production conducted in 2015, where HHs were chosen completely randomly as long as HHs grow any plum tree, for this pear survey, only HHs that considered pear production an important part of their farming system were included. We changed the survey method because we wanted to understand the knowledge, practices, production volume, and income of commercial farmers engaged with markets. That gave us a better base to estimate the potential for developing the pear industry.

Our survey conducted in 2017 showed that on average in Si Ma Cai HH has 112 trees (0.34 ha) with an average age of 3.6 years, in Sa Pa, 43 trees (0.21 ha) with an average age of 2 years and Bac Ha, 35 trees (0.08 ha) with an average age of 5.2 years. All of the planting material in Si Ma Cai and Sa Pa was provided for free, while in Bac Ha, 80% of farmers got free grafted seedlings from the government, 15 % of farmers bought planting material from the nursery and 5% produced themselves. All farmers applied fertilisers, over 90% of farmers in Si Ma Cai and Bac Ha pulled down the top of the branches to stimulate fruiting, and 60% of farmers in Bac Ha and 20% in Si Ma Cai bagged the fruit. Overall, farmers growing pears were better trained, and they invested more inputs and labour than plum farmers. Based on survey data average production cost was around 2,500,000 VND (not including establishment cost) and 40 labour days (including bagging) with an average income of 13,500,000 VND. However, the estimate was based on young orchards yielding only 4-6 kg/tree. Because production from these young trees was still small, most of the fruit was sold locally with a high price of around 40,000 VND/kg, reaching up to 70,000 VND/kg.

7.4.4 Pear-Consumer preferences

A short consumer study was conducted in 2017 to establish consumers preferences for the type of pear and their origin, type of outlets and packaging, perception of fruit safety (i.e. if they think pesticide residues are present) and the main motivation for buying pears (i.e. consumption vs offering to ancestral spirits). Consumers surveyed (n=154) were predominantly female (89%), with 45% of respondents coming from middle and higher-income households and 60% of respondents being below 45 years of age. They were interviewed after buying pears in supermarkets (n=36), fruit shops (n=38), wet markets (n=38) and street vendors (n=38) in Hai Ba Trung and Gia Lam districts of Hanoi.

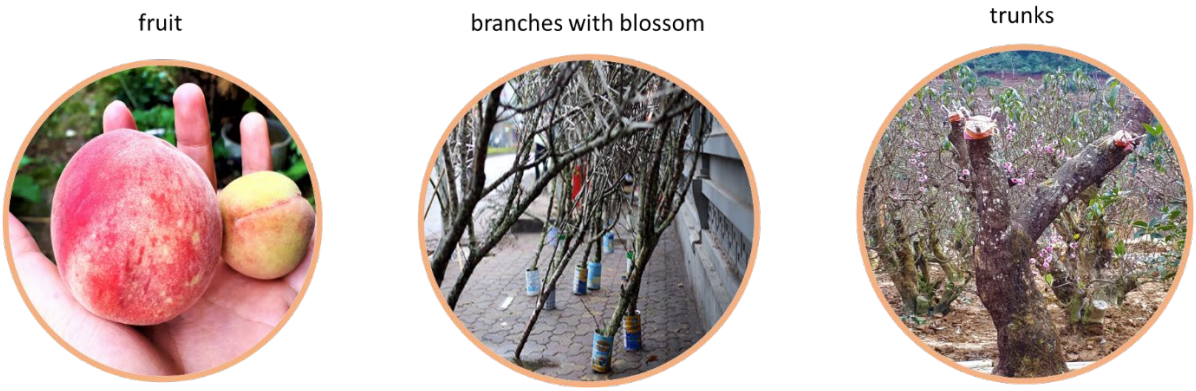
The two types of pears sold were Asian pear (*Pyrus pyrifolia*) and European pear (*Pyrus communis*), with Asian pear dominant in the market. Overall, consumers rarely buy pears, with 77% of respondents buying pears less than once a month, 12% once a month and only 6% buying pears every week. Asian pear is more frequently purchased, with 74% of respondents purchasing Asian pears at least once and only 38% of respondents ever bought European pear. The vast majority (89%) responded that the origin is important. Consumers prefer pears imported from western countries (including South Africa, the major supplier of European pears to Vietnam), followed by equally ranked Korean and Japanese imported pears and Vietnamese domestically produced (very low volume) and finally, Chinese pears, which are not preferred by 75% of respondents. However, because of much lower price, Chinese pears are the most frequently purchased. Asian pears are perceived safe by 55% of respondents and European pears by 72% of respondents. The difference is most likely because European pears are mostly imported from western countries.

Most respondents usually buy pears from wet markets (31%), followed closely by supermarkets (27%) and fruit shops (21%), making pears one of few fruits where wet markets are not by far dominant market outlets. Most pears are bought for offerings to ancestral spirits, especially for funeral ceremonies.

Most consumers (64%) prefer to buy pears without any packaging, but if packed, then plastic net is preferred.

7.4.5 Peach production in NW Vietnam

In Vietnam, peach is grown on approximately 1,500 ha, mainly in Lao Cai and Son La provinces. The Lai Chau provincial government is developing 40 ha of peach as part of 200 ha planned until 2025. Even though the production area is not large, it is estimated that close to 10,000 HHs are involved in the production, with peach providing important additional earnings and cash flow in the period January to April when there are very few other sources of income. Farmers sell flowering branches and trunks as TET holiday decorations in January and early February and fruit in late March until May (Fig XX). For most farmers, the sale of “decorative trees” for TET is more important than fruit production.



Picture 6: There are three marketable products from peach: fruits, flowering branches for the TET holiday and trunks for grafting ornamental *Prunus* species.

There are two major types of peaches grown: local peach and “French peach”. Local peach is hardly edible and is used to produce flowering branches and trunks. It is also used as rootstock for grafting introduced stone fruits, not just peach, but also plums and nectarines. French peach is a common Vietnamese name for several peach varieties introduced from France a long time ago. It is difficult to determine which varieties were introduced and currently grown, but Micret seems to be the most common.

Total fruit production is below 2,000 t, and most fruits are sold locally to tourists in Sa Pa, Bac Ha and Moc Chau. In the Long Bien wholesale market, we only recorded Vietnamese-produced peaches in 2016, and it represented only 0.1% of traded volume; the rest was imported from China. Fruits are sold in the early stages of ripening, when still very hard and red colour just started to develop (Pic 7).

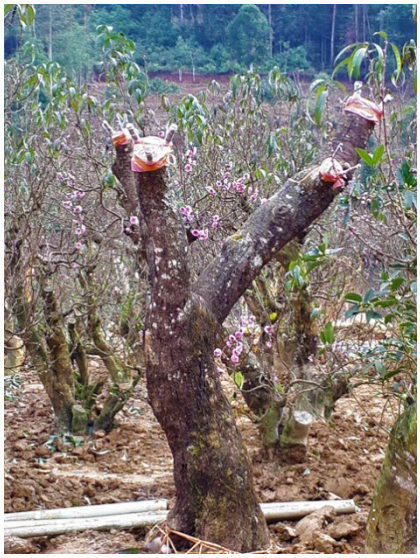
Picture 7: "French peach" dominant peach produced in Vietnam sold in early stage of ripening

Farmers lack knowledge and skills to manage peach fruit production, and generally, there is very limited government support for current peach growers, partly because farmers are more interested in producing decorative branches than producing fruit. However, there were two government-funded projects in the period 2011 to 2018. In Lao Cai, 50 ha of French peach were established, and in Lai Chau, 40 ha of peach variety, DCS1, introduced to the province by previous ACIAR project AGB-2008-002, was established. The extension services, supported by our project, provided farmers' training on orchard design and planting, fertiliser application, and canopy management to support the establishment of these orchards. The peach production from these areas is still small and mostly sold on the local markets. However, any further efforts to increase production has to be part of systematic development that will address postharvest handling and the logistics of supplying Hanoi and other lowland markets.

Production and trade of decorative branches and trunks

Most traded branches are 2-5 years old and are sold from 100,000 to 500,000 VND. A minimum requirement for all branches is the presence of flower buds, and then the value is increased based on the colour and shape of flowers, size and shape of branches and presence of lichen (Pic 8). Younger, smaller branches that appear old and have lichen can be sold for up to 1,000,000 VND, but branches over five years old can be sold for several million dongs and reaching 40,000,0000 VND for branches over ten years old covered with lichen with a lot of flowers. There is a great deal of subjectiveness in the appraisal of branches' value, so the above prices were the best estimate obtained in 2017.
Trunks are sold as rootstock for grafting ornamental *Prunus* species. Sometimes already grafted trunks are sold (Pic 9), but often only trunks are sold, and grafting is done after transportation to customers.

Picture 8: Branches with lichens that appear old and with a lot of flowers are preferred.



Picture 9: Truncks grafted with ornamental *Prunus* species are in demand

Farmers usually start selling fruit in the second year after planting and continue harvesting for up to ten years. The first branches are usually cut in the third year when one or two branches out of four that make a typical vase-shaped tree are taken. They usually regrow in two years and then are cut one more time. Branches not cut in year three are then cut in the fourth and fifth year after planting and often for a higher price than younger branches cut the previous year. In the end, around eight to ten years after planting, farmers may sell trunks.

In summary, the well-managed tree can produce around six branches during its ten-year lifetime, yield fruit at a rate of 30-50% of the normal yield of trees without branches being removed and finally, the trunk. However, the major problem for farmers is managing flowering, especially because the lunar new year (TET holidays) can fall anytime between late January and mid-February. As most farmers don't know how to manipulate flowering by applying phytohormones they try to diversify flowering time by planting different varieties and planting trees in warmer and cooler places. In this way, they get at least some trees flowering at the right time for TET. Few farmers stress the trees by removing leaves to induce flowering.

Farmers may benefit a great deal from a project that would develop technologies for flowering manipulation and shaping of branches, but it seems neither government nor foreign donors take the "TET decorative tree" industry seriously. Even in our project, we

did not conduct systematic research on the commercial value of this aspect of the peach production system. Data presented in this report is the result of a small add-on research activity after we realised the size and importance of this additional product while we were researching fruit production.
The production of decorative branches is large enough for the supply chains to urban centres in the lowland to be developed (Fig 27). Collectors, who are usually peach growers, buy branches from farmers and sell them to assembly traders, who then transport them to Hanoi and other lowland cities. However, collectors and farmers sell many branches directly to tourists and visitors, transiting along the National Road 6 connecting Hanoi to Son La and Dien Bien provinces. We did not research the Hanoi market.

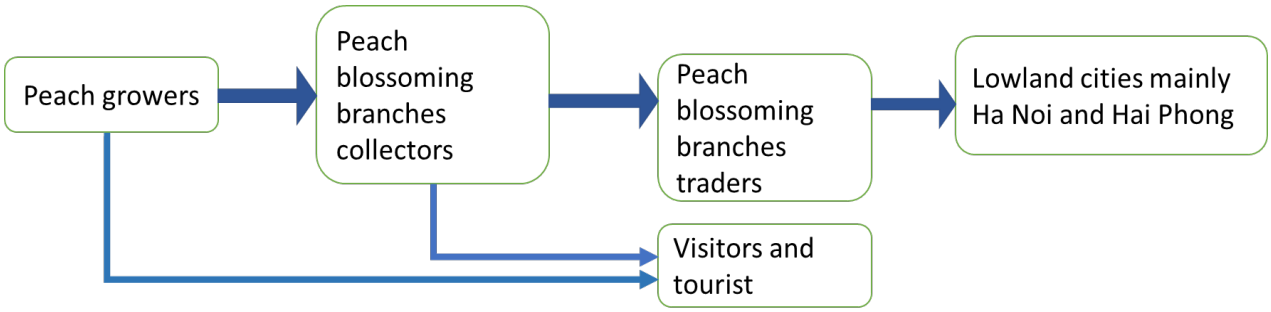


Figure 27: Decorative branches supply chain

7.4.6 Persimmon production in NW Vietnam

There are two types of persimmon grown in Vietnam: the astringent type making up the vast majority of persimmons grown in Lang Son and Bac Giang in Northeast Vietnam and Lam Dong province in Southern Vietnam, and the non-astringent type mainly grown in Lam Dong and Son La provinces (Fig 28)

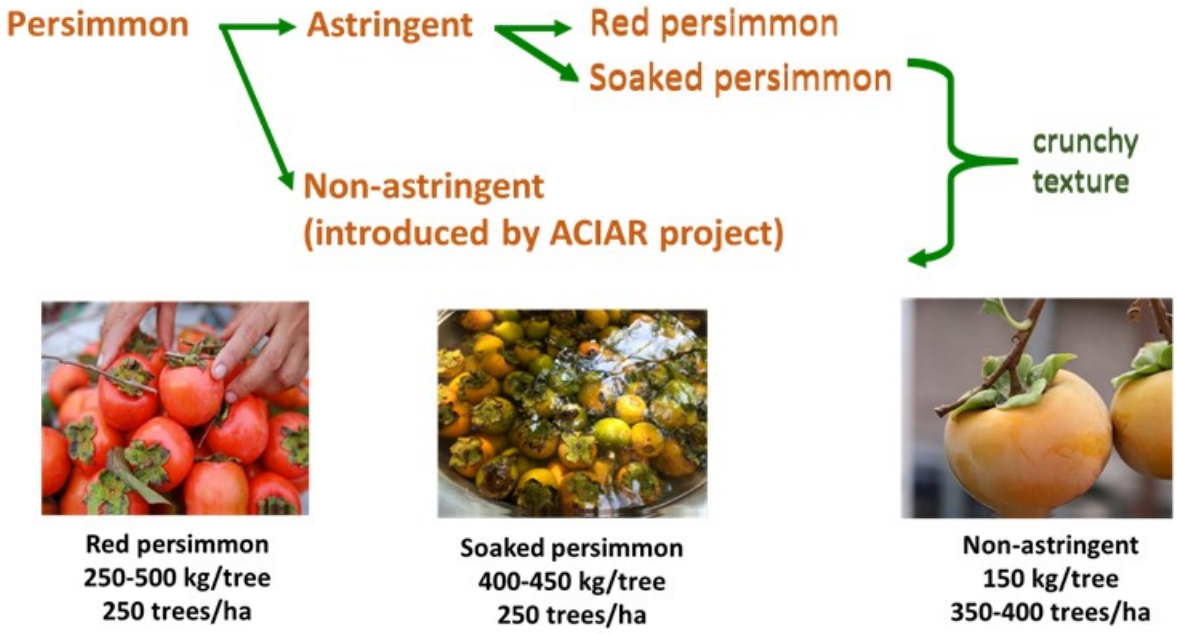


Figure 28: Types of persimmon

The astringent varieties can be consumed as red persimmon and soaked persimmon. Red persimmon is fully ripened persimmon with very soft and sweet flesh. Red persimmon dominates the late season (October-November), and the most popular are red persimmon varieties Trung Loc and Vuong from Da Lat (Lam Dong province). Soaked persimmon is astringent persimmon that has been soaked in water to wash off astringency. Soaked persimmon is crunchy and has similar eating characteristics to non-astringent persimmon. Varieties Van Xeo and Bao Lam from Lang Son are the most popular soaked persimmons in the Hanoi market, with a peak season in September.
Consumer research conducted in 2016 in Hanoi that involved 115 persimmon consumers showed that 71% of consumers purchased soaked persimmons at least once during the 2016 season, and 44% and 46% purchased non-astringent and red persimmons, respectively. Soaked persimmons are more consumed than other types by both age groups, younger consumers 45 years old and below, and older consumers above 45 years old, with the preference more pronounced for younger consumers (79% younger consumers vs 62% older consumers). Red persimmons were more often purchased by older consumers (53%) than younger consumers (40%), and non-astringent persimmons were bought nearly equally by both age groups (42% vs 47% for younger and older consumers, respectively). For all types, the primary reason for purchasing was eating and not offering to ancestral spirits. However, red persimmon was more popular for offerings than other types, with offerings being the major reason for purchasing for 39% red persimmon, 24% non-astringent, and only 16% soaked persimmon. Taste and texture and not appearance and colour are the main determining factors for purchasing persimmon.

Production in Lao Cai and Son La provinces

In 2014, when our project started in Lao Cai province, persimmon was grown on 264 ha producing 629 t mainly sold locally as red persimmon. In Moc Chau, approximately 150 ha of persimmon was grown with 86 ha fruiting, and the rest were still too young to bear fruits. In 2017, 648 t of persimmon was produced, of which 340 t was non-astringent persimmon, mainly Fuyu variety. Production of Fuyu will increase because most of the grafted seedlings were planted in the mid-2010s and will reach full production six to seven years after planting. The current production is largely from the original astringent persimmon trees that were grafted with Fuyu scions. The introduction of non-astringent varieties in Moc Chau is the result of ACIAR project AGB/2006/066, and the inclusion of persimmon as one of the focus fruits in our project was to support the marketing of predicted large volumes of non-astringent persimmon produced in Moc Chau. However, because of problems with rootstock compatibility, many newly planted orchards did not develop, and it seems that the production of top-worked trees declines after a few years. Our research on adoption barriers showed that the training of farmers conducted during the previous project was inadequate, with many farmers having no recollection they ever attended the training. The current Son La DARD plan for the fruit sector development until 2025 predicts a very small increase in area planted with persimmon reaching only 200 ha. Despite difficulties, persimmon production has the potential for high returns. A small number of farmers who manage to master the cultivation of Fuyu persimmons have very good economic returns, with farmgate price being four to five times higher than for red persimmons (Fig. 29).

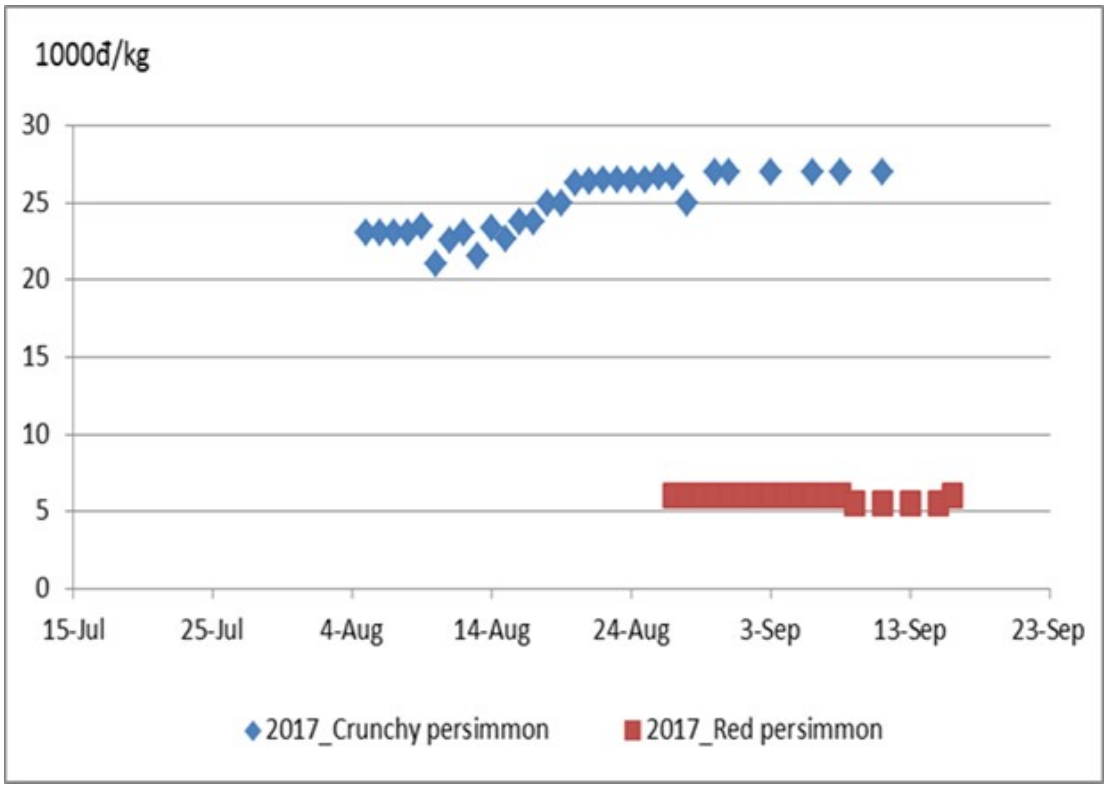


Figure 29: Farmgate price of non-astringent (crunchy) and red persimmon in Moc Chau (2017)

Drying astringent persimmon also represents an opportunity for adding value to red persimmons that are much easier to grow and yield more per tree. Production of Hoshigaki style (Pic 10) whole dried persimmon has great potential for developing small scale processing in Moc Chau.

Picture 10: Hoshigaki style dried persimmon opportunity for “cottage scale”processing

7.5 Barriers to adoption of technical innovation by smallholder farmers

7.5.1 Research methods

Comparative case study on five projects implemented in NW Vietnam

NOMAFSI research team selected a total of five projects for the comparative case study: three projects funded by national and local governments ("Development of pilot production of some imported TF varieties in Lai Chau province" implemented in 2011 – 2015 by NOMAFSI; "Development of local TF varieties in Sa Pa and Bac Ha Districts of Lao Cai province" implemented in 2004 – 2007 by Lao Cai Department of Plant Protection; "Development of comprehensive technologies for quality TF production in the Northern mountainous provinces" implemented in 2004 – 2006 by PPRI) and two international (ACIAR) funded projects "Improving the productivity and quality of sweet persimmon in Vietnam and Australia" implemented from 2008 – 2012 by PPRI and "Improving the postharvest quality of Temperate Fruits in Vietnam and Australia implemented in 2004 – 2007 by PPRI). Initially, the criteria for the selection was that projects were completed around five years before the study was conducted, but in the end, projects were selected based on the accessibility of project reports and stakeholders involved in their implementation, with project completion ranging from 1-9 years from the time of the study.

The study involved the analysis of project proposals and reports, key informant interviews with implementer and funders of the projects, and three focus group discussions for each studied project a) with farmers involved in the project and adopted innovations, b) with farmers involved in the project but not adopted innovations, and c) with farmers not involved in the project but who live in the project location and may, or may not, adopt some of the innovations developed by projects. The research team investigated the project proposal development and implementation process, including the extent of participation, involvement of stakeholders, and the way monitoring and evaluation was conducted. Communication strategies and stakeholder capacity building associated with the introduced innovations, and finally, the team evaluated the quality of the technical innovations and their appropriateness for farmers' environmental and socio-economic realities.

Analysis of factors impacting the implementation of projects focusing on ethnic minority

The study employed an anthropological approach and applied qualitative methods for primary data collection and primary and secondary data analysis.

In particular, it involved a review of secondary data and published reports and literature to build knowledge about past projects.

Primary data collection and analysis involved: non-structured interviews of 64 farmer interviews from seven ethnic groups in Moc Chau and Bac Ha to understand factors affecting ethnic livelihoods, agriculture, and forest management and farmer expectations, problems and outcomes with temperate fruit projects; 11 in-depth interviews with farmers outside the three study case projects, in-depth interviews with two project leaders; and direct observations during field visits of orchards, farms and collectors' trading activities.

Research activities included:

(i) *Analyse available secondary data from temperate fruit projects since 2005 to understand the level of knowledge project teams had about the targeted areas (often ethnic groups) before the design and implementation of the projects, and to explore whether this knowledge could have been incorporated into the project's activities;*

(ii) Understand the attributes of the projects that had established good relationships with ethnic people, achieved the project objectives and integrated project activities into farmers' daily activities and their rhythm of life;
(iii) Explore the local history of relations between farmers and projects to understand better what farmers' perceptions of different projects were;
(iv) Understand what factors can support or can hinder the effectiveness of a project.

Perception and beliefs of Dao and Hmong ethnic minorities about fruit and forest trees and their utilisation

The study was conducted in July 2018 with Black Hmong in Pa Khen 3 village and with Red Dao in Phieng Sang village in Moc Chau district of Son La province.

The study applied several qualitative research methods in the two study villages.

Four focus group discussions (FGD), two in each village, were conducted to explore farmers' cultural and spiritual beliefs, perceptions about fruit trees, and reasons for their plum management practices. Each FGD consisted of six farmers, a mixture of men and women. They were selected randomly from the list of households provided by the village leader.

Representative photos of different plum tree pruning and training techniques (from recommended to farmer practice) were used to initiate discussions about farmers own management techniques and encourage them to describe what they were currently doing in their orchards, why, and evaluate how easy or difficult it would be to adopt different techniques.

Information from FGDs was supplemented with direct observations to better understand village history, the vulnerability context of households, the evolution of farming strategies to cope with the vulnerabilities, and the enabling and dis-enabling factors to obtain their life goals.

Detailed semi-structured interviews were conducted with 18 households; nine households in each village of which three were categorised as "Better-off" and six "Poor" households. On most occasions, both the household wife and husband participated in the interviews.

Key informant interviews were also conducted with village leaders, plum traders, local spiritual leader (shaman) and the head of lending groups in each village.

Semi-structured household interviews and FGDs were designed to explore the following questions:

(i) What are farmers in different socio-economic groups (poor compared to better-off) currently doing with plum?
(ii) Why are they doing what they are doing?
(iii) How and to what extent do culture and spiritual belief influence their plum production practices?

Interviews were conducted in Vietnamese, with the assistance of local Hmong interpreters in Pa Khen 3. Interview responses, direct observations and other data were captured in field notes, and digital recordings later transcribed for analysis.

7.5.2 Results and discussion

Comparative case study on five projects implemented in NW Vietnam

Results show that the main barriers to the adoption of improved production practices are related to the following factors: (i) lack of consultation with local stakeholders during the design phase of the project, (ii) lack of participatory approaches to facilitate the involvement of stakeholders, especially the local authority, extension officers and farmers in project

implementation, (iii) inappropriate communication strategies, (iv) poor linkages to local government initiatives and lack of follow-up activities after project completion, (v) inappropriateness of techniques in the local context and high cost for their adoption, and (vi) poor and unstable supply chains.

The main barriers to the introduction of new varieties is an undeveloped nursery industry that suffers from lack of autonomy from government institutions, over-reliance on projects, a lack of entrepreneurship and international contacts and inability to collect royalties resulting in limited access to new varieties.

The lack of participation of local stakeholders, including government institutions, farmers, input suppliers and traders in project formulation and implementation, is the main underlying cause of poor adoption of project outputs. Because research institutions work in isolation, project teams usually make an improper selection of sites and/or households, improper identification of priorities, improper planning and implementation of activities, and finally, the technologies developed are unsuitable for the local socio-economic and/or environmental context. After project completion, the local institutions, who were not involved in the project implementation, do not have the necessary human and financial resources to support the adoption of project outputs through necessary technical training of farmers or building farmer capacity to access finance to enable the implementation of new technologies. Lack of capital is often the main barrier hindering farmer adoption, even when they understand well and know how to apply new practices.

To overcome these barriers, research priorities should be based on strategic plans for the temperate fruit industry development on national and provincial levels. Design of research projects should be a consultative process involving a broad range of industry stakeholders and should be aligned with local government priorities. The monitoring and evaluation of project implementation should be a participatory process involving local institutions, the private sector and farmers. Development of support mechanisms for the adoption of new technologies should be part of the project itself, or it can be a separate activity but should be coordinated with the project implementation. To facilitate these processes, our project has developed provincial and interprovincial forums as the platform for dialogue between all stakeholders involved in the TF industry and has worked with the provincial government of Son La and Lao Cai provinces on the development of strategic plans for TF industry development based on potential supply capacity and market demand. Strategic plans have also identified research priorities and capacity building needs of local government institutions, private sector stakeholders and farmers (The strategic plans were finalised as part of SRA AGB/2018/171).

Analysis of factors impacting the implementation of projects focusing on ethnic minorities

The review of project-related documents exposes a common lack of attention paid by project teams to the local development context and history of targeted ethnic communities. Projects seldom consider the way beneficiaries think about development and how they would like to achieve it. There is a pluralism of interests in communities because not all individuals have the same plans or wishes for their future and related development, but instead of listening to community voices, project teams often push their development vision on communities. Project development goals are usually based on the Vietnamese government goals imposed by international donors (World Bank, European Union, TPP) without proper understanding of the local context. The criteria for choosing projects are: in the worst-case, western-centric; in the best-case, nation-centric; and rarely local community-centric. This top-down approach goes against the participatory approach and is unsuitable for implementation at the local level, especially in communities dominated by ethnic minorities. In most cases, little, if any, attention is paid to the nuanced local social networks and local power relations, resulting in most projects being unpopular or having little impact in targeted areas and communities.

The local memory and history of development projects are very important. A village that may have already had a negative experience with a project will likely be sceptical towards any new project. New projects often do not consider that they "harvest the crop, either good or bad, planted by previous projects". In addition, the level of trust between the projects' stakeholders and local ethnic communities commonly become an issue. Project staff are often Kinh, outsiders who may not know much about the community. Local leaders, including heads of the village, Party, Farmers Union, Women's Union and Extension Services, are usually entrusted with selecting and engaging local participants because they have a more nuanced understanding of all the households in the villages.

On the one hand, this is a great way to integrate the project into the social, administrative, economic and local policy system. On the other, there is a risk of misappropriation of project objectives and clientelism with the selection of unsuitable households preferred by leaders for personal reasons. Furthermore, even when local leaders foresee the unsuitability of a proposed project, they still may decide to welcome the project because they are worried that if they refuse, the community will lose their opportunity to participate in a worthwhile project in the future.

The project should have a flexible logical framework that allows the researcher teams to contextualise the project activities for each targeted area. There is great diversity in production levels, market engagement, land topography, and climate conditions. Thus, project implementation needs to be adaptive to embrace farmers' realities in different locations and transform the project focus and activities to suit beneficiaries own needs and capacities. If the project team adopts an inflexible top-down approach, beneficiaries adopt a passive attitude towards the project. However, if the project team does not facilitate the adaptation of project activities to suit the local context, then local community leaders often re-appropriate development projects' resources, which enables assistance to be redirected to some households and villages in need, but, unfortunately, the re-distribution of benefits is rarely fair or equitable and often captured by local authorities or powerful families who profit from these arrangements.

Analysis from case studies confirmed the need for a participatory approach. Projects without a logical framework were more successful in achieving development outcomes. However, this does not mean that the project teams implemented ad-hoc activities. Instead, project teams were hands-on, gaining knowledge about the local context and building a good relationship with all stakeholders, allowing them to design suitable activities for each village, implement activities with the most influential and motivated members, and adapt activities when necessary. Teams with rigid approaches often failed, but the reason for the failure is not attributed to improper logical framework and research leading to development activities, design, and implementation of these activities logical framework but to ethnic minorities being "backwards" and "attached to primitive beliefs, superstitions, and taboos", hindering development.

Perception and beliefs of Dao and Hmong ethnic minorities about fruit and forest trees and their utilisation

A central question that underpinned this study was whether the cultural and spiritual beliefs of local ethnic Hmong and Dao farmers in two Moc Chau villages influences their perception of trees and their willingness to adopt "improved" plum management practices. This study confirmed the strong animist beliefs of Hmong and Dao farming families that objects, places and creatures all possess a distinct spiritual essence. However, both groups reported their beliefs didn't explicitly determine how they should manage their plum orchards because they see plums as "foreign". Farmers were often reluctant to conduct invasive techniques such as pruning, canopy training or fruit thinning because they see trees as a living spiritual beings, but also they were not convinced of the financial benefits. Therefore, it is difficult to conclude whether these perceptions are linked to their animist belief system or simply that they don't feel good about damaging what appears to them as a healthy and productive tree

and are unconvinced or sufficiently motivated by the benefits of doing so. Our market and value chain study showed that if the farmers cannot access premium markets, hard pruning and thining that reduce yield and improve the quality of fruits have a negative economic effect.

There was stronger evidence that suggested farmers reluctance to adopt “improved” plum management practices was influenced by their socio-economic situation and their rational estimation of the costs, benefits and risks of various actions and options. Many farmers are either aware of or capable of applying or adapting improved plum management practices. Many also demonstrated they are willing to quickly adopt other new crops and practices. However, most farmers chose to minimise the management intensity, particularly inputs of labour and cash to their plum gardens, and target the green-unripe plum market. Poor households have little or no cash to invest in improved management; they may be in debt and lack available cash for food and necessities for several months of the year. Therefore, these families need to strategically allocate their scarce labour and cash, considering where their investment will generate the best returns.

Picture 11: Focus group discussion with Dao female farmers in Phieng Luong, Moc Chau, Son La

Access to finance

Access to finance or credit is often reported as a major factor constraining farmers ability to adopt and invest in new “improved” technologies, crops or practices (Tarozzi *et al.*, 2015). The project team also identified lack of finance as one of the possible causes of poor adoption of “improved” plum orchard management practices in Moc Chau, but little was known about the availability of financial products and behaviour and attitudes of local farmers towards formal and informal sources of credit.

The Vietnam Bank of Social Policies (VBSP), The People’s Credit Fund (PCF), and Agribank are the three main sources of formal institutional finance and credit available to farmers in Moc Chau. Moneylenders based in each village are the main source of informal credit. This section examines the products and attitudes of lenders towards smallholder farmers and the attitudes and use of ethnic farmers’ in the two Moc Chau study villages towards formal and informal sources of finance. The implications for farmer practice and adoption will then be discussed

Lenders

The Vietnam Bank of Social Policies (VBSP) is a not-for-profit financial institution established by the Vietnamese government to provide credits for social purposes. It implements lending programs targeting various groups such as poor households, near-poor households, ethnic minorities, SMEs, and family businesses in disadvantaged areas, and programs for development activities such as job creation, access to clean water and environment improvement, initial funding for Vietnamese workers to access the international labour market, and housing in disadvantaged areas.

VBSP does not interact directly with loan recipients but instead distribute loans and collect payment through mass organisations, most commonly farmer union and women union, at commune and village level. Loans are only available when the bank implements programs in designated communes. When funding is available, Farmer Unions and Women Unions would inform people in the village so that eligible households can register for the program. Most VBSP loans administered through Farmer Union and Women Union are for “poor” and “near-poor” households. The interest rate for these loans are very low (around 6% per year), and no collateral is required. Eligible households only need to register with the Unions staff at the village level, who would use their local knowledge to filter out people unlikely to repay.

The maximum loan provided is 50,000,000 VND, but most loans are less than 10,000,000 VND. Repayment for most loans is one year, but loans for financing fruit and cattle production, e.g., establishing orchards and breeding studs, is for five years.

People’s Credit Fund (PCF) is another well-known financial institution among farmers. Unlike SPB, which is a government institution for financing the implementation of government policies, hence use of loans is limited to the policy prescribed purpose; PCF is a financial cooperative providing the loans to meet their members’ needs. Farmers can easily get loans from PCF if they can provide the land-use right certificate (a.k.a. red book) as collateral. However, PCF provides loans at a higher interest rate than VBSP, usually 1-1.2% per month, and the loan has to be repaid in regular monthly repayments.

Moc Chau PCF has more than 2,000 members whose obligation is to initially contribute 300,000 VND to the fund and then make a yearly contribution of 100,000 VND. The maximum contribution to the union capital is limited to 10% of the total capital. Moc Chau PCU has 16 billion VND charter capital and 330 billion VND total operational capital, mainly contributed by approximately 40 members, who get most of the profit dividend. PCF is allowed to loan out 90% of capital with the interest rates regulated by the government.

Moc Chau PCF is managed and operated by 25 professional staff and a number of PCF members who act as agents in communities recruiting new members and offering loans.

From farmers’ feedback, it seems that PCF is more accessible than other official financial institutions, but farmers are still often hesitant to give “red book” as collateral and to commit to monthly repayments.

Agribank was established on March 26, 1988, and since 1996 its full name is Vietnam Bank For Agriculture and Rural Development. In 2020, Agribank’s total assets reached over VND 1.57 million billion. Agribank’s credit growth rate increased by 7.8% while net interest income reached VND 43,660 billion, the highest in the Vietnamese banking system. For the whole year, Agribank’s pre-tax profit reached VND 13,203 billion, down 5.5% compared to the previous year

While most Agribank activities are purely commercial, the Agribank still has an obligation to implement a number of government’s policies and distribute financial support (usually in the form of low-interest loans) to poor households. In Moc Chau, Agribenk has been implementing the government programs’ loans (Decree 41) to poor households in the same way the SPB has been managing their loans (see above), with mass organisations being the main partner in administering loans.

However, Agribank main business is to provide commercial loans directly to farmers. The bank has two office buildings, one in TT Moc Chau and one in TTNT Moc Chau, and five transaction points operating one day a month in Truong Son (on the 5th of each month), Tan Lap (10th), To Mua (20th), Na Muong (15th), Van Ho (5th). The bank also works with village heads and other influential community members, who become their agents, provide information about loans, and facilitate the loan approval process for a fee.

Except for the government programs' loans targeting poor households, Agribank requires collateral from borrowers, usually a red book. Typical loans are up to 200 million with a repayment term of up to three years. There is no special policy for ethnic minority groups. The cooperative directors and other customers perceived as reliable can get discretionary loans approved by the bank manager for up to 200 million without collateral.

Joint Stock Commercial Bank for Investment and Development of Vietnam (BIDV) was established on April 26, 1957, as Bank for Construction of Vietnam. After many changes, on May 1, 2012, BIDV was successfully transformed from fully government own to a joint-stock commercial bank with majority government ownership and private equities. As of December 31, 2020, BIDV's total assets had reached VND 1.49 million billion, an average growth of 10.4% per year during 2016-2020.

In Moc Chau, BIDV only provides larger loans to agricultural businesses and does not provide loans for financing the production of small farmers. The bank had a program to finance cooperatives, but because cooperatives could not provide collateral (land is own by individual members, not a cooperative), the assigned loans were not awarded, and the program was closed.

Smallholder ethnic minority farmers

Contrary to common belief, especially among donors and NGOs, the study found that ethnic minority households in Pa Khen 3 and Phieng Sang had adequate access and frequently used informal and formal sources of finance and credit for various purposes. Informal credit and formal loans were often used to purchase inputs for the next crop or invest in new higher-value cash crops, such as beans, chayote, and passion fruit. However, poorer households frequently also relied on credit and small loans from money lenders to purchase staple foods and other essential household items.

In both study villages, almost all farmers accessed credit or cash loans from local money lenders, and up to 60% of farmers also accessed larger cash loans from various formal financial institutions such as VBSP, Agribank or PCF.

The flexibility, accessibility and quality of services provided by formal financial institutions at the village level was quite different and significantly influenced farmers choice of lending options locally. The study found that the connection of lenders with village leaders (head of the village or leaders of Farmer and Women Unions) or influential people in villages (e.g. large farmers and traders) influenced farmers attitude and choice of finance, rather than a preference for one financial institution over another. For example, the PCF and VBSP were the two most popular formal lending sources for Hmong farmers from Pa Khen 3, whereas Agribank and VBSP were preferred by Dao people in Phieng Sang. PCF is actively promoting itself in Pa Khen 3 by providing good customer services and a friendly lending environment. Hmong farmers in Pa Khen 3 did not borrow from Agribank because they disliked the complicated paperwork, strict collateral requirements and unfriendly customer service. In contrast, Agribank and VBSP were the most popular lending sources for Red Dao farmers in Phieng Sang. The positive experiences with Agribank appear mainly due to the good customer service provided by the leader of the lending group based in the village, an easy to prepare loan application and the low interest rate.

The study also established that farming households socioeconomic status influenced their choices of financial products (credit and loans) and types of lenders. Poorer households prefer to borrow smaller amounts with a higher frequency to meet their immediate needs; therefore, they tend to access most easily and locally available credit. Poorer households

prefer to borrow smaller amounts with a higher frequency to meet their immediate needs. The formal financial institutions are often inflexible and not accessible in remote areas where many ethnic people live, so local money lenders provide an important source of readily available credit and loans to the poor households in those areas. Everyone in Pa Khen had loans with private money lenders because loans were straightforward to access, had flexible repayment arrangements, did not require collateral and were confidential. Farmers in both villages were less concerned about the interest rates than the repayment terms. However, when repayments are delayed, even small debts rapidly accumulate, sometimes to levels that are impossible for poor families to repay. Indebtedness was an issue for some households, with a significant negative impact on the participation of these families in development processes.

Many poorer farmers in Pa Khen 3, especially those without collateral, will continue to borrow from informal sources unless the financial institution change collateral requirements, offer smaller variable loans with flexible repayments, better and more locally accessible customer service, and faster, less complicated application and approval processes.

Better-off farmers like to borrow larger amounts (greater than VND 100 million), most often from financial institutions. Loans are used mainly for investing in agriculture or other business. In Phieng Sang, Red Dao farmers' socio-economic situation is better than Hmong families in Pa Khen 3. The results from Phieng Sang suggest that more people access formal lending because they have more formal collateral and more frequent, higher year-round income from tea and higher value cash crops. This small, but regular income earned throughout the year, ensures farmers can pay for necessities such as food and other daily expenses and reduce the need to regularly borrow small cash amounts from private money lenders. However, it is worth noting that besides land resources, better market linkages (enabled by roads) allow farmers to diversify their crops, which buffers them from market volatility (as in the case of maise). It shows that land ownership, market linkages, farmers income and credit are intricately linked.

Loans provided by VBSP provide an important, affordable and accessible source of finance for many of the poorest households. However, despite their very low subsidised interest rates and that land use certificate do not have to be provided as collateral, their loan products and processes often do not provide the convenience and services offered by local money lenders. VBSP bank currently offers fixed, relatively large loan amounts to farmers. Many eligible farmers are reluctant to borrow from VBSP because they are uncomfortable with the relatively large standard loan sizes, which, if not kept securely, could be stolen, lost or wastefully spent. Farmers' anxiety partly comes from being indebted and partly because most households do not have a safe place to put or save their money. Bank accounts are still not common for poor farmers. Swinkel and Turk (2006) also found little use and provision of saving facilities by formal banks, despite an urgent need. They concluded that currently available savings products are inadequate, and a wider range of services would be needed. Minimum deposits should be lowered, and mobile banking facilities are required.

VBSP and lending institutions such as Agribank and PCF should evaluate and promote products that promote savings. The potential for e-banking solutions (e.g. cashless wallets, digital payments), widening the network and access of local banking agents and bundled insurance products could also be further examined. One option worth exploring could be to provide and encourage savings accounts for households linked to pre-approved overdraft or loan accounts for poor households. This would enable families to easily borrow small amounts up to a limit and provide an account to promote saving and quick regular repayment.

Factors influencing attitudes of smallholder ethnic minority farmers towards formal and informal finance

From the study, it was possible to summarise the key factors that influence the attitudes and choices of ethnic group farmers towards formal and informal finance. These factors

can be grouped into three contextual areas: 1) lender characteristics, 2) borrower characteristics, and 3) external influences.

Key factors associated with **finance lenders** include:

- **Collateral requirements for securing a loan and the risk of losing land.** Most formal lending institutions require collateral, normally a land-use certificate, to secure a loan. However, many ethnic and poor households either do not hold a land-use certificate or are extremely wary about using their land as collateral for a loan. Rather than require formal collateral, money lenders charge a risk premium in the form of higher interest rates, which is generally acceptable and preferable to farmers in need.
- **Local accessibility, convenience and quality of customer services.** Formal lenders who provide a trusted agent in and from local communities are often well regarded and utilised. Similarly, money lenders are often located in the village and provide efficient services with few restrictions.
- **Speed, efficiency and paperwork required to provide credit or a loan.** Securing a loan from formal lending institutions often requires a lot of paperwork and documentation, may take several weeks to approve and disburse funds, and often requires multiple trips to branches or agents. All these are major disincentives for many poor ethnic households to use institutional lenders. Moneylenders are locally accessible and provide credit or loans on the spot, without any procedures or paperwork.
- **Flexible loan products, loan sizes and repayment terms.** Ethnic farmers and households often require frequent, small loans, with flexible repayment terms aligned to highly uneven seasonal cash flow and crop calendars. Whilst money lenders can provide these services, loans from formal lenders are generally for fixed larger amounts than are immediately required and have rigid regular repayment terms.
- **Level of trust in the lender, institution or local lending representative.** Trust is a major factor. Farmers are much more likely to utilise service if they trust the local agent or lender.
- **Confidentiality.** Ethnic farmers are proud and avoid being named and shamed by public broadcasting names of people late in their repayments to formal lenders. Moneylenders are often more discrete and confidential.

Key factors associated with **borrowers** include:

- **Land ownership and size.** The ownership, size and quality of farmers' land underpin the capital wealth and food security of farming households, their ability to increase and diversify their income, and ability to provide collateral for the loans. Farm size for many households is very small, and many either do not have land-use certificates to use as collateral or are unwilling to provide their land as collateral for fear of losing it.
- **Savings and non-land capital assets such as livestock.** Most ethnic minority households had no cash savings and limited capital reserves for crop inputs or emergencies. No families had bank savings accounts. Buffalos and cattle provide an important capital reserve for many households; however, most own only 1 or 2 heads or even none. This lack of savings increases the reliance on loans from money lenders in emergencies.
- **Cash flow and diversified sources of income.** Many households lack any cash or cash income for large periods of the year. Better off, households with land can diversify and increase their year-round income and cash flow by producing a range of higher value cash crops, such as tea, plums and vegetables, and some households from wage employment. High-value crops and employment significantly reduce reliance on frequent credit or loans from money lenders for

crop inputs, food purchasing, and unforeseen expenses. They are also more likely to meet the fixed payment terms of formal loans.

- **Availability and opportunity cost of labour.** Many households rely on supplementary cash income from seasonal employment to pay for food and household expenses and repay debts. Seasonal migration of male farmers to better-payed seasonal work in China is common, leaving women with the extra burden of running the farm.
- **Level of indebtedness.** Some households may accumulate relatively large informal debts due to crop failure, low prices for commodities they produce and unforeseen emergencies. A spiral of indebtedness creates debt bondage, which may be passed onto subsequent generations. Their situation is precarious, with little hope for the future. Further borrowing to adopt or invest in new crops and technologies is outside their reach.
- **Proximity and access to local markets**. Farmers with land and good access to traders and markets have more options to increase and diversify their income and cash flow. They are more able and likely to borrow from formal lenders to invest in new crops and technologies.

Key external factors include:

- **Agricultural risk factors.** Farmers are exposed to market price volatility, pest and disease outbreaks, variable climate and seasonal rainfall, which can severely reduce crop yields, product quality and farm gate prices. When yields and prices are good, debts can be repaid, and surplus cash can purchase crop inputs and support household expenses for the coming months. However, in some years, crop income may be lower than the cost of production. This forces farmers to rely on credit to purchase crop inputs for the next season and buy food and household needs. Published research shows that when these risks can be reduced through insurance, farmers are more likely to borrow and invest.
- **Unforeseen emergencies and expenses.** Health crises, education needs and ceremonial commitments (funeral, weddings, honouring ancestral spirits) incur large and often unexpected expenses and burdens on families. Many poorer ethnic families without sufficient capital reserves or savings are left with no choice but to borrow money, mostly from local money lenders.
- **Changes to government policy and regulations.** Any changes in national and local policies affecting land ownership, financial institutions, crop subsidies, and local fees and taxes for capital infrastructure funds influence households' financial situation and borrowing behaviour. The appropriation and reallocation of agricultural land have major negative results on affected households reducing their primary source of income and collateral value and causing increased reliance on informal debt, leading to indebtedness.

7.6 Scientific impacts – now and in 5 years

The project made a major contribution to the ACIAR organised symposium “The Mountain of Opportunities” on agricultural research and development in NW Vietnam. The project team members had several keynote presentations and posters.

Project team members used the learnings from research on the implementation processes and their impacts to contribute to the publication “Making Value Chains Working Better for the Poor”, ACIAR Monograph 212, and to paper “Designing research for impact: A framework guiding transdisciplinary research for sustainable development”, which the Project Leader presented as a selected speaker at Development and Sustainability Conference, Michigan University, Ann Arbor, Michigan, USA, in November 2018.

The learnings from this project were also presented in the paper “Market Orientation in Agricultural Value Chain Development Projects” by Phillip Currey and Oleg Nicetic, published in Australasian Agribusiness Review in 2020.

The findings presented in this report provide an excellent source of data and analysis for several journal papers, but it is unlikely that the former project team members will find time to actually write any papers. The project team was not embedded in a University system as it was made up of five experienced international consultants, with the project leader being the only University staff member but holding an externally funded full-time research position. This team composition was geared towards development rather than academic outcomes, so without additional funding for the consultants to be involved in writing papers, a limited contribution to academic literature is to be expected.

7.7 Capacity impacts – now and in 5 years

The capacity building of young Vietnamese researchers was an important part of the project. In the year of project implementation, thirteen training activities were conducted, focusing on understanding and facilitating participatory and transdisciplinary research processes. Training in quantitative research methods was also conducted and included the development of survey instruments for market and consumer research and post-survey data management and analysis. Qualitative research methods including focus group discussions, semi-structured interviews, in-depth interviews, comparative case studies, and ethnographic research methods were also covered. The training was delivered as a hands-on workshop with a small number of participants and ongoing on-job training and support. All these activities increased the capacity of Vietnamese institutions, including FAVRI, NOMAFSI, CASRAD and VNUA, to conduct interdisciplinary research.

After the formal training in the form of workshops was conducted in the first year of the project (Table 2), the focus in the remaining three years of the project was on mentoring and continuous on-the-job training and support of younger and mid-career Vietnamese staff conducted by the senior Vietnamese staff and international experts. While training included both quantitive and qualitative research methods and analysis, the largest needs for support and training was in areas of stakeholder engagement and explorative, less structured methods of enquiry, including rapid market appraisal, farmer network analysis and using in-depth interviews and focus group discussion instead structured surveys to understand market dynamics.

Ms Le Thi Hang Nga was awarded a JAF scholarship and she commenced her Masters degree in anthropology in January 2016. The project will also support the candidature of Mr Nguyen Nam Hai for a JAF scholarship.

Table 2

Dates	Activity/Training topics	Participants	Funding
24th- 25th July 2014	Training on transdisciplinary approaches, market and consumer research methodologies	Key staff from FAVRI,VNUA,CASRAD, NOMAFSI, PPRI, PPSD and UQ/ UA	ACIAR - project budget
10th Sept 2014	Training on ethnographic research methodology	Key staff from NOMAFSI, PPRI	ACIAR - project budget

26-27th Sept. 2014	Training on transdisciplinary approaches, market and consumer research methodologies, ethnographic research methodology	Key staff from NOMAFSI, PPRI	ACIAR - project budget
18 Oct. 2014	Developing methods for comparative case study and review secondary data on introduction of TF production and adoption	Key staff from NOMAFSI, PPRI	ACIAR - project budget
22 Nov. 2014	Training on developing methods for questionnaire for key informant interview (activity 3.1) and FGD methodology	Key staff from NOMAFSI, PPRI	ACIAR - project budget
3 Dec. 2014	Training on data collecting methods	Key staff from NOMAFSI, PPRI	ACIAR - project budget
28th Jan. 2015	Training on designing tools to track wholesale markets in Hanoi.	Key staff from FAVRI, CASRAD, VNUA	
29th Jan.2015	Training on the structure of overview secondary data reports for plum, pear, peach, and persimmon.	Key staff from FAVRI, CASRAD, VNUA	ACIAR - project budget
30th Jan 2015	Training on developing the methodology to conduct focus group discussions with 3 groups of consumers (Low-Middle and High income) for plum, peach in Hanoi	Key staff from FAVRI, CASRAD, VNUA	ACIAR - project budget
2-3 Feb. 2015	Workshop on developing methods for data collection at the community level (focus group discussions), methods for compiling data	Key staff from NOMAFSI, PPRI	ACIAR - project budget
3 Feb. 2015	Training on the design of farming system survey focusing on temperate fruit	Key staff from PPRI, CASRAD	ACIAR - project budget
6th Feb. 2015	Training on designing the toolkit for the survey on collectors, wholesalers for plum, peach.	Key staff from FAVRI, CASRAD, VNUA	ACIAR - project budget
17 April 2015	Workshop on data analysis	Key staff from NOMAFSI, PPRI	ACIAR - project budget

7.8 Community impacts – now and in 5 years

Our project was designed to build on the initial achievements of ACIAR project AGB/2008/002 “Improved market engagement for sustainable upland production systems in the North West Highlands of Vietnam”, and Association Sud Ouest pour le Développement International Agricole funded development programme focusing on plum production and processing in Moc Chau and Van Ho districts. Therefore, impacts presented in this section can not just be attributed to our project but are also the result of these previous projects and several Vietnamese national projects implemented in Son La, Lao Cai and Lai Chau provinces just before or in parallel with our project. The team members of our project also took part in the other projects.

7.8.1 Economic impacts

Plum production in Moc Chau and Bac Ha in 2016 and 2017 was very profitable, with income for many farmers exceeding 100,000,000 VND per hectare and for farmers in prime production areas reaching 300,000,000 VND/ha. Plums significantly outperformed maize, with income from maize being 30-50,000,000 VND/ha, a stark contrast to the situation in 2009 when the project team initiated work on the development of plum value chains as part of project AGB/2008/002. At that time, Tam Hoa plum was seen by Vietnamese researchers as a commodity “to feed poor students” with no future, with the income from plum hardly reaching 20,000,000 VND per hectare which was below the income from maize. Several factors were contributing to the booming plum industry including access to the Chinese market, improved quality of plums, and an improved marketing image of the NW mountainous area as a source of healthy food, resulting in higher demand for Tam Hoa plums in Hanoi and HCMC. Our project has substantially contributed to a better understanding of markets, particularly the Chinese market, by the major traders and local policy-makers through provincial forums and by facilitating engagement between local government institutions and stakeholders involved in plum supply chains. Project activities have strengthened existing supply chains and opened new high-value markets by facilitating the relationship between supermarkets and safe food shops in urban areas and local traders, and producers and facilitating the VietGAP certification and formation of cooperatives.

Farmers in Son La province experienced a doubling of their income from low-quality plums exported to China for processing in the reporting period, and income from good quality plums for traditional markets in Hanoi and HCMC more than doubled. In Son La, in 2016, 20,000 t of plums was traded with an average price of 600 A$/t, an increase in value of 300 A$/t in comparison to 2010, indicating that around 6,000,000 A$ was added to plum industry revenue with poor farmers from ethnic minorities being major beneficiaries. The absolute number of 6 million Australian dollars may not seem very impressive, but the income increase for around 10,000 households growing plums was enough to lift many of them out of poverty. Unfortunately, these gains are unlikely to be sustained in the next five years due mainly to a recent large expansion of the plum planting areas with production expected to triple by the early 2020s, which will be coupled with the projected decline of the Chinese processing industry causing major oversupply.

The project team discussed in detail the downfalls of unsustainable development of the industry based on only one plum variety with a harvesting season of only six weeks. The project team mobilised the provincial and district DARDs and People’s Committees in Son La province and engaged with the major stakeholders in the private industry to develop a strategic plan for the development of the temperate fruit industry in Son La province based on improving nurseries capacity to introduce new PBR varieties, diversifying industry with the introduction of suitable peach, nectarine, passionfruit and avocado varieties, and developing a processing industry. The project team also mobilised private industry to start

the process to form an industry association with the support of local government and MARD. The development of the strategic plan, introduction of licenced peach and nectarine varieties from Australia and formation of the Temperate Fruit association of Son La province was included in follow-up ACIAR funded project AGB/2018/171 “Strengthening leadership, coordination and economic development of the temperate fruit industry in northern Vietnam”, implemented from April 2019 to July 2021.

The project team also significantly contributed to establishing the temperate fruit industry in Lai Chau province, negotiated the supply of seedlings from Lao Cai provincial nursery to Lai Chau and supported Lai Chau extension services to train farmers in fruit cultivation and pest and disease management.

7.8.2 Social impacts

The project has had a major impact on provincial planning and investment decisions that laid the foundation for developing a more sustainable temperate fruit industry in Son La and Lai Chau provinces. In Lao Cai, the project team put a lot of effort into working with Lao Cai provincial DARD to develop technical management guidelines and business plans for the Bac Ha nursery to expand and possibly privatise but with lesser success. While many aspects of technical guidelines were adopted, the leadership of the Bac Ha Station and the parent organisation, the Lao Cai Provincial Breeding Centre, were apprehensive about working on the business plan and mobilising capital through the privatisation. The hesitancy to develop an ambitious business plan to expand and diversify production was partly due to satisfactory profitability of the current operation, which includes successful pear breeding program and ownership of breeders rights for VH6 pear variety, and partly because Bac Ha Station and nursery occupy a prime real estate location, so the management feared that motivation of any private investment might be to develop a tourist resort and displace the Station and nursery.

The project team worked closely with the Lai Chau government to assess the feasibility of establishing a fruit nursery in Lai Chau province and concluded that the current demand for grafted seedlings in the province was not large enough for profitable nursery production and that Lai Chau DARD does not have the necessary expertise and appropriate location to establish and run the nursery. The project team then facilitated negotiations between Lao Cai Breeding Centre and Lai Chau DARD, resulting in reversing the official Decision (Quyết định) of Lai Chau People’s Committee to build a nursery in Lai Chau province and instead, the official agreement between Lao Cai Breeding Centre and the Lai Chau DARD for the supply of peach, plum and pear seedlings for Lai Chao province was signed. This win-win agreement facilitated the successful establishment of pear and peach orchards in Lai Chau and boosted the productivity of Lao Cai nurseries.

Son La DARD and the Provincial Nursery embraced the opportunity to work with the Australian nursery experts and the nursery industry to improve the production of their nurseries and start restructuring the operation to handle the introduction of varieties for which royalties have to be paid. As described in the economic impacts section, ACIAR project AGB/2018/171 continued to support the Son La Provincial Nursery restructure.

The development of the fruit industry and especially processing, nurseries, and value chains have positively impacted employment, especially of women. Women are in many cases proven to be better in pruning younger trees and grafting than men resulting in a high percentage of women working in nurseries. In the developing value chains, jobs were created by increasing needs for grading, sorting and packaging. The project team worked with several stakeholders, including the largest cooperative 19 May from NT Moc Chau, to evaluate the feasibility of the processing, including dried fruit, jam, preserves, and pickles. The findings were incorporated in the temperate fruit strategic plan and acknowledged by local DARD as a priority opening the way for developing the household and community small and medium scale processing.

7.8.3 Environmental impacts

Expansion of fruit trees orchards on slope replacing maize production has a positive impact on managing soil erosion and reducing pesticide and herbicide use, in particular on significantly reducing atrazine use.

7.9 Communication and dissemination activities

7.9.1 Internal project communication

- Formal internal project communication was materialised through annual reflection and planning workshops focusing not just on reporting and analysing results and planning new activities but also on conducting capacity development activities, particularly on methodological approaches and related methods.
- The full-time project coordinator (initially Ms Le Thi Hang Nga and in the last three years of the project, Ms Dinh Thi Huyen Tram) successfully facilitated communication between researchers across institutions through small, focused face-to-face meetings and Facebook later Zalo groups. The database was organised on Google Drive, where all documents and reports were stored, and notifications with the updated list of stored documents organised per activity in the Activity table were then regularly circulated to all team members. Never before had team members experienced such easy access to all, even initial draft, project documents across all partner institutions.

7.9.2 Communicating research results to the wider community

- The project team has established and maintained relationships with District People's Committees, the provincial and district DARDs, farmer organisations and supply and value chain actors through regular face-to-face meetings at least every three months, forming Zalo groups, and providing regular briefs summarising findings from market and consumer research and their implications for TF industry planning and supply and value chain development.
- Stakeholders feedback and planning sessions were organised twice a year. The main purpose was to share the tentative results of market and consumer research and development of value chains, receive feedback from the stakeholders, and discuss how the research findings can improve stakeholders businesses. Stakeholders meetings were pivotal to plan activities to further improve the functioning of value chains.
- NOMAFSI created an open-access database on their website and collated a library of reports and extension materials from various national and international projects related to all aspects of fruit production and trading.
- The project sponsored farmers, traders, and processors to participate in various local and national fairs and tourist events. These events were used to promote Son La and Moc Chau cooperatives and traders brands as well as products' geographic origin by displaying and organising degustation of high-quality local fruit.
- The project team supported the organisation of an ACIAR sponsored symposium, "The Mountain of Opportunities", on agricultural research and development in NW Vietnam. The team presented the development of the temperate fruit industry in the NW through several presentations and a number of posters.

Provincial and interprovincial forums

During the project proposal development, forums were envisaged as the platform for communication with local governments to influence their planning and policies. In the initial project document, provincial forums were planned for each year (4 forums for each province, making a total of 12 forums in the life of the project) and three interprovincial forums (joint forums for 3 provinces where each province would take a turn to be the host). During the organisation of the first provincial forum, it became apparent that costs

were far above the budget and that the temperate fruit industry in Lai Chau was so undeveloped that it would be better to organise combined forums for the two neighbouring provinces (it is only 2.5 hours drive between Lai Chau and Lao Cai cities). After the first provincial forums (one in Lao Cai and another in Moc Chao), which were very successful in gaining attendance of very high officials, including Vice Chairmen of District's People's Committees, directors of DARDs from provinces and districts and a representative from MARD, we realised that we cannot simply present results or progress of research, but we have to have sets of well analysed high-quality data with defined implications for production, trade and policies that can then be discussed with high-level officials allowing us to refine our conclusions and also to generate the interest of the officials and motivate them to act on the presented information and proposed actions. In the first forums, our presentations were based on work from the previous project, especially on understanding the processing industry in China, so our presentations were interesting enough, but we concluded that we would need at least two years of market data to have analysis strong enough to present at subsequent high-level forums. As a result, only two provincial forums and two inter-provincial forums were organised:

- The markets for the NW region's temperate fruit in Vietnam and China – the current state and opportunities for market development.
  The provincial forums were held in September 2015 in Lao Cai for Lao Cai and Lai Chau provinces and in Moc Chau for Son La province.

- The opportunities for the development of the nursery industry in NW Vietnam.
  The provincial forums were held in May 2016 in Lai Chau for Lai Chau and Lao Cai provinces and in Son La for Son La province.

- Understanding branding and protection of geographical indication.
  The interprovincial forum was held in Ba Vi resort in June 2017.

- Strategic Plan for the development of temperate fruit industry in Son La and Lao Cai provinces – change in markets since the first provincial forum and strategic plan based on market potential encompassing production, development of new markets and building capacity of all value chain actors.
  The interprovincial forum was held in Moc Chau in July 2018.

As a result of the first forum, leadership of all three provinces prioritised the diversification of the varietal portfolio and, connected to that, investment to improve nurseries. The decision was made to further investigate the feasibility of the development of the processing industry, especially if the fruit can be processed in Vietnam and then exported to China instead of exporting raw fruit for processing in China. The signing of the agreement between Lai Chau and Lao Cai provinces on the supply of grafted seedlings produced in Lao Cai to establish orchards in Lai Chau was a direct result of the forum. In follow up from the forum, the project organised the visit of Moc Chau People's Committee and DARD, together with key traders and processors, to China to better understand the plum processing industry and negotiate an agreement on further cooperation. Details from the China visit will be presented in the AGB/2018/171 report.

At the second forum, results from Peter Young's audit of nurseries in NW Vietnam and an overview of nursery production and standards in Australia were presented. Following the forum's discussions and decisions, the project team worked with Bac Ha and Son La nurseries to improve production processes based on Nursery Industry Accreditation Scheme (Australia) (NIASA) standards adapted to Vietnamese conditions. The need for most improvements was in phytosanitary protocols.

The first interprovincial forum on branding and protection of geographical indication was different from the previous two forums, targeting high-level professional staff in DARD, Department of Science and Technology and Department of Planning and Investment, large traders and processors who had the capacity to develop their own brands, and not

political leaders. Consequently, the forum was organised as a scientific symposium on the first day, explaining the differences between promoting the origin and the Geographic Indication (GI) certification and differences between the certification, collective and individual business trademarks. On the second day, the focus was on discussing the best approach to branding for temperate fruit. As a direct result of the forum, the plan for promoting Moc Chau origin was developed instead of an official geographic indication for Moc Chau plums, and a few traders and cooperatives developed their individual and collective trademarks.

The last forum attracted high-level political leaders and officials from three provinces and resulted in the decision to establish Son La province temperate fruit association and introduce new licenced varieties from Australia to Son La. The participants also endorsed a draft strategic plan with the suggestion for further improvement of the plan.

It can be concluded that the forums were a great success, but there is no simple formula for organising forums that could be easily replicated. Each forum was very different in the way it was run. The first forum had a more or less standard workshop format with presentations followed by group work and reporting of the group work with discussions and recommendations for further action. The main difference was that actionable agreements and decisions could be made at the forum because of high-level delegates' participation. The project team could clearly see that this format was not appropriate for high-level political participants as it was too long with too many scientific details being presented. Any subsequent forums involving high-level political officials had two parts: a shorter part focusing on high-level officials (only one morning followed with lunch) where summaries of major findings were presented with clear implications for government policies and investments and the follow-up, usually longer part of the forum after high officials leave, where the plan of activities was developed with government institutional staff, based on directives from the high-level officials attending the previous session.

The final forum had a panel session with the vice-director of Son La DARD, the director of the largest cooperative in Moc Chau, a large plum trader and a few lead researchers from the team as panel members. They were discussing ways to develop the temperate fruit industry in the NW of Vietnam, and the main audience was a large number of cooperative leaders, large traders and farmers. The panel session was facilitated as a “Question and Answer” event where a few key questions were communicated to the panellists in advance, but most questions came from the audience. This event's high success is attributed to the Vietnamese facilitator being very familiar with many audience members, so she could effectively encourage the audience to ask difficult questions and honestly voice their opinions. A workshop then followed the morning session for participants interested in establishing the Son La Temperate Fruit Association. At the workshop, a committee comprising very influential cooperative directors and traders was formed, which followed up with activities resulting in the establishment of the Association two years later.

In conclusion, the forums were one-day events, but they were focal points for the research activities and engagement process both before and after the forums.

8 Conclusions and recommendations

8.1 Conclusions from research activities with recommendations

8.1.1 Development of market-driven temperate fruit industry

GIS mapping (See Map 1&2) showed that large areas in Moc Chau (Son La) and Lai Chau provinces are suitable for producing low chill temperate fruits with chill units of 250 and below. There are also several areas where fruit varieties with 250-600 CU requirements can be grown, but most of these areas are very remote, and investment in infrastructure, including access roads, is needed before starting production of medium to high chill fruits. Even though a GIS map was not produced for Lao Cai province, data available at the provincial DARD level was sufficient to determine the situation in Lao Cai was similar to Son La and Lai Chau. Considering these natural conditions and market demand, low chill peaches and nectarines, early plums, Asian pear and avocado have great potential to be profitably grown, reduce regional dependence on maize production and improve soil erosion management. Non-astringent persimmon varieties also have good market potential and could be recommended if technical solutions are found for current problems in nursery production.

Son La province has developed a large and still expanding plum industry mainly due to its competitive advantage in having a Tam Hoa plum variety preferred by Vietnamese and Chinese consumers harvested two to three weeks earlier than in competing Lao Cai province and China. The Son La provincial government also stimulated the development, as a part of its efforts to diversify from the dominant maize production, by providing free, good quality planting material and technical support. The competitive advantage and stimulative policies resulted in 10,000 ha under plum production, making Son La by far the largest producer, with Lao Cai with 800 ha coming second. However, the latest massive expansion in Tam Hoa's growing areas that more than tripled between 2015 and 2019, was mainly driven by positive market signals with farmers starting new orchards using their own marcotted planting material or buying grafted seedlings from private nurseries and not through the government providing free planting materials.

Unfortunately, our market analysis showed that plum over-supply is inevitable. In 2016, when the expansion in new planting areas began, the supply was well-matched with demand. The market value could grow by improving fruit quality, but there was limited potential for growth of supply volume. Two market segments, the Chinese market for processing quality plums and the Hanoi market for average quality fruit, accounted for 70% of market volume and were at their peak, while the Chinese processing market will most likely decline and the Hanoi market remain stable.

Most growth potential exists in Chinese fresh fruit markets for high-quality plums to capitalise on Son La's competitive advantage of earlier harvest compared to China, but there is a considerable risk in developing this market due to trade regulation uncertainties related to export to China (The current export is unofficial see 7.4.2 and Fig 22). Another opportunity is to grow markets in Ho Chi Minh City and Central Vietnam, but even if this market segment (2,000 t in 2016) doubles its volume, the increase will account for only a small fraction of increased plum volume from the recent production expansion.

The predicted oversupply will cause a significant price drop in the early 2020s, which may stimulate increased consumption in urban areas and eventually stabilise prices, but many growers producing low-quality fruit could be forced out of the market. The Son La government and other donors should evaluate the development of the fruit processing industry to capture opportunities from abundant, cheap, locally produced plums. On the positive side, larger growers producing high-quality plums in prime areas, including communes of Pak Hem, Ban On, Cu Do, are most likely to continue developing viable plum industry, supplying urban markets and contributing to the development of agritourism

in Son La province.

The temperate fruit industry in Lao Cai is much smaller but more diverse, with nearly equal production areas of plum, pear and peach. However, development is still based on a very limited number of varieties of each species, with the provincial government directing most of the resources into the development of VH6 pear production. Our market research showed that a planned increase in VH6 production to 4,500 t by 2025, harvested in early summer (June and early July), would compete with 3,000 t imported from China currently sold in the Long Bien market at the same time of the year at the low price below 20,000 VND. Lao Cai farmers cannot compete with Chinese imports on price, so they have to use their competitive advantages, mainly a strong preference of Vietnamese consumers for domestically produced pears that are on par with Korean and Japanese imported pears sold, putting Lao Cai pear producers in a position to sell a good quality VH6 pears for 30-40,000 VND/kg, approximately half of the price for Korean pears and double the price of low-quality “Chinese yellow” pear. Other potential competitive advantages include seasonality and vicinity to the neighbouring Chinese province of Yunnan, opening export opportunities. VH6 pear can be harvested two to three weeks before pears grown in China’s pear production centre in Hebei, more than 2,000 km away from Yunnan.

Therefore, a shift in government strategy away from the subsidised expansion of planted areas based on a single variety with a short harvesting season is necessary to develop a sustainable industry. The local government working closely with the private sector should focus on key sources of competitiveness of their regions compared to other fruit production regions in Vietnam and China. The proximity of China is a source of competition in the domestic market, but equally, it gives export opportunities that should be well understood before developing any strategic development plans. The development of nurseries with diversified portfolios of productive and marketable varieties should be prioritised. Earlier varieties should be favoured to capture export opportunities and shield farmers from import competition. Research institutions in cooperation with the extension services should develop technologies specific to the targeted markets, e.g. in areas producing mainly plums for processing orchards can be redesigned to increase planting density and crop load and increase efficiency and profitability of production. The coordinated effort of government extension services and input providers would improve critical technical know-how to farmers to increase the proportion of good-quality fruit that meets consumer preferences in Vietnam and China. The establishment of the temperate fruit industry associations in each province, comprising leading farmers, cooperatives, traders and processors, could be an important step towards the stronger influence of private industry and market signals on government planning, policies and allocation of resources.

8.1.2 Hanoi temperate fruit market

Hanoi temperate fruit market has been dominated by fruit imported from China. In the major Hanoi wholesale market, Long Bien, between 2015 to 2017, 66-86% of plums, 65-78% persimmons and nearly all peaches and pears traded were imported from China. At the same time, the market share of Vietnamese plums grew from 14 to 34% and persimmons from 22 to 35%. Data show that importers very skillfully regulated the supply volume from China so that traded volumes and prices were not negatively correlated, i.e. in months when sale volume peaked, the prices were also highest. In contrast, the relationship between sale volumes and prices is negatively correlated for Vietnamese fruit, with a dramatic reduction in prices recorded during peak plum season. There is a significant variation in quantities and varieties of fruits imported from China from year to year, indicating that imports from China are not part of any marketing strategy, but Chinese traders offer varieties of fruits when there is a surplus in Chinese markets. Finally, data indicated that Vietnamese fruits positioned themselves between cheap Chinese and expensive Korean and Western countries imports.

The modern fruit retail segment is very heterogeneous. Retailers differed considerably in

terms of size, marketing strategy and sales performance. Suppliers in production areas will need to develop differentiated product and pricing strategies to meet retailer requirements and maximize the benefits to farmers and their own businesses.

The safe-food retail segment is particularly small and fragmented. However, businesses in this segment are innovative and willing to sell fruit with a high price and low volume, making them suitable partners for introducing new fruit varieties into the market. As demonstrated for the newly developed Lao Cai VH6 pear, the segment can effectively promote the new product and its origin through various channels, especially social media. Cooperation with this segment should also be considered for developing a regional branding for a range of products.

The sale of Tam Hoa plums from Son La to modern retailers more than doubled from 2016 to 2017 but still represented less than 1% of total plum sales. While direct income from this segment will remain relatively modest over the foreseeable future, there is much scope for growth, and other impacts should also be considered. The presence of Vietnamese plums in modern retail outlets have changed the perception of local plums as a low-status fruit, leading to increased consumer demand. The status of plums has also been assisted by strong tourist promotion, whereby plum orchards together with tea gardens represent a major attraction in Moc Chau. In 2017 the plum harvest festival attracted more than 7,000 visitors to the district and received high media coverage.

The growing involvement of modern retailers should also result in a more enabling technical- and quality-upgrading environment. This could have spillover effects on plum farmers supplying traditional market segments, while quality assurance systems or product branding strategies developed for plums may be applied to other smallholder farm products.

8.1.3 Barriers to adoption of technical innovation by smallholder farmers

The main barriers to the adoption of improved production practices are related to the following factors (i) lack of consultation with local stakeholders during the design phase of the project, (ii) lack of participatory approaches to facilitate the involvement of stakeholders, especially the local authority, extension officers and farmers in project implementation, (iii) inappropriate communication strategies, (iv) poor linkages to local government initiatives and lack of follow-up activities after project completion, (v) inappropriateness of techniques in the local context and high cost for their adoption, and (vi) poor and unstable supply chains.

The review of project-related documents targeting ethnic minorities exposes a common lack of attention paid by project teams to the local development context and history of targeted ethnic communities. Projects seldom consider the way beneficiaries think about development and how they would like to achieve it. There is a pluralism of interests in communities because not all individuals have the same plans or wishes for their future and related development, but instead of listening to community voices, project teams often push their development vision on communities.

To overcome these barriers, research priorities should be based on strategic plans for the temperate fruit industry development on national and provincial levels. The design of research projects should be a consultative process involving a broad range of industry stakeholders and should be aligned with local government priorities. Monitoring and evaluation of project implementation should be a participatory process involving local institutions, the private sector and farmers. Development of support mechanisms for the adoption of new technologies should be part of the project itself, or it can be a separate activity but should be coordinated with the project implementation. When projects involve ethnic minorities, then attention has to be paid to the nuanced local social networks and local power relations, and project implementation needs to be adaptive to embrace farmers' realities in different locations and transform the project focus and activities to suit beneficiaries own needs and capacities.

The study on the influence of ethnic minority beliefs on adopting new technologies, especially pruning, confirmed the strong animist beliefs of Hmong and Dao farming families. They believe that objects, places and living creatures all possess a distinct spiritual essence. However, both groups reported their beliefs didn't explicitly determine how to manage their plum orchards because they see plums as "foreign". Farmers were often reluctant to conduct invasive techniques such as pruning, canopy training or fruit thinning because they see trees as living spiritual beings, but also they were not convinced of the financial benefits.

The study on access to finance concluded that most farmers have access to institutional and private landers loans, but because farmers often require frequent, small loans, with flexible repayment terms aligned to highly uneven seasonal cash flow and crop calendars, taking loans from private lenders is more common. Farmers' hesitance to use a land title as collateral and the complexity of financial institutions approval processes are other major factors for farmers preference for private loans despite higher interest rates. To overcome these barriers, many institutional lenders have their agents in communities. The agents are eighter trusted individuals like village leaders or mass organisations, including Woman or Farmer Union. Institutional lenders should diversify their portfolios to include microfinance products without collateral, even if that means increasing interest rates if they want to serve more small farmers.

The main barriers to introducing new varieties are an undeveloped nursery industry that suffers from a lack of autonomy from government institutions, over-reliance on projects, a lack of entrepreneurship and international contacts, and inability to collect royalties resulting in limited access to new varieties.

8.2 Conclusions from development activities with recommendations

1. The major constraint identified impacting temperate fruit industry development is the lack of coordination between different stakeholders in the private sector (seedling producers, growers, traders, retailers and processors) and between the private sector and local government. This has been resulting in top-down government-led sector planning with little basis on market information. Another limiting factor is the under-developed nursery industry, which still lacks access to modern varieties (due to the inability to conform to international standards on variety protection) and thus still heavily relies on a few varieties with short harvest time.

   The project initiated the formation of a Temperate Fruit Industry Association by establishing a working group in May 2018 to develop the 'pilot' Temperate Fruit Association in Son La province to address the above main issues. The main objective of the Association as drafted by the working group is to (1) facilitate collaboration between different stakeholders in the industry, (2) represent its members to liaise with the government and inform the planning and policymaking processes, and (3) promote RD&E and especially the introduction of new varieties. The Association will further develop the initial Strategic Plan for temperate fruit development drafted by the project.

   Future external support is needed for developing Association's organisation and management structures, communication mechanisms, and information management systems required for an industry association to function efficiently and benefit its stakeholders. Building core leadership and governance capacity and advocacy skills for association members are also necessary.

2. Further research is needed to evaluate options to enhance temperate fruit nursery production and variety management capacity and improve access to improved varieties outside Vietnam. MARD has facilities to access PBR varieties and legal framework for their protection in Vietnam, but DARDs and nurseries on the provincial level lack the

capacity to comply with the legal and commercial IP protection requirements. Further investment should be directed to the Son La Temperate Fruit Industry Association to develop sustainable variety protection and royalty collection mechanism to conform with international standards and thus get access to modern protected varieties.

3. Further research and feasibility studies into processing opportunities are recommended to address the oversupply of plums and identify opportunities for fruit production targeting processing and meeting processing industry requirements.
4. Provincial and interprovincial forums were effective platforms to initiate system-wide change within provinces. The key to successful forums was a long consultative process with the participants leading up to the forum and follow up activities with participants to assure decisions made at the forums were implemented. Future forums should be planned as short events, typically one day, with the first part focusing on high-level officials (usually one morning followed with lunch) where summaries of major findings are presented with clear implications for government policies and investments and the follow-up (usually in the afternoon or next day) where the plan of activities are developed with government institutional staff, based on directives from the high-level officials attending the previous session. A forum can also be an effective platform to mobilise private sector actors for development activities. It is recommended that the forum format be trialled for dialogue between provincial and central level institutions.

9 References

9.1 List of publications produced by the project

The following peer-reviewed extended abstracts were published and are available at: https://vietnam.embassy.gov.au/files/hnoi/North%20West%20Vietnam%20Research%20Symposium_%20ENG.pdf

1. Oleg Nicetic, Tiago Wandschneider, Le Thi Hang Nga and Le Quoc Anh: Trends, patterns and implications of the cross-border plum export trade from Vietnam to China
2. Nguyen Huu Nhuan, Elske van de Fliert and Oleg Nicetic: The role of collaborative learning in the adoption of soil erosion management strategies in maize production and improvement of smallholder livelihoods
3. Pham Thi Sen, Oleg Nicetic and Gordon Rogers: Horticultural crops as drivers of profitable smallholder farming
4. Nguyễn Duy Phượng, Vũ Hoàng Lâm, Lưu Ngọc Quyến, Nguyễn Văn Chung, Lê Thị Hằng Nga, Hà Tiết Cung, Lê Thị Hoa Sen, Nguyễn Nam Hải, Nguyễn Văn Ch, Phạm Thị Sến, Oleg Nicetic: Main barriers to adoption of technical innovations for temperate fruit production by smallholder farmers
5. Pham Van Hung, Tiago Wandschneider, Nguyen Thi Duong Nga, Nguyen Thi Thu Huyen, Ninh Xuan Trung, Tran Van Long, Pham Kieu My and Oleg Nicetic: Market prospects for Vietnamese pear and implications for government intervention
6. Tiago Wandschneider, Nguyen Thi Duong Nga, Pham Van Hung, Nguyen Thi Thu Huyen, Ninh Xuan Trung, Tran Van Long, Pham Kieu My, OlegNicetic: Supply seasonality and competitive advantage: The case of plums in Vietnam
7. Tiago Wandschneider, Bui Quang Duan, Le Nhu Thinh, Dinh Thi Huyen Tram, Nguyen Minh Chau and Oleg Nicetic: Linking plum farmers to modern retail chains in Hanoi: Rationale, emerging outcomes and development potential