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Piloting digital monitoring of VietGAP compliance and quality in Vietnam vegetable value chains

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prepared by Liam Southam-Rogers

*co-authors/
contributors/
collaborators* Gordon Rogers, Henry Hyde, Dallas Gibb, Nguyen Thi Nga

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2 Executive summary

The project developed and tested low-cost digital tools to help vegetable farmers in Son La province supply modern retail supermarkets and specialty retailers in Hanoi with VietGAP compliant, high-quality vegetables. The project filled a traceability gap identified in ACIAR project AGB/2014/035.

A smart phone app was adapted and used to collect vegetable crop production and handling information including farmer, crop, cultivar, pesticide applications, planting / harvest dates, required for VietGAP compliance. Low cost Escavox GPS-enabled temperature and humidity loggers were used to track consignments and monitor conditions. The Hitachi virtual control tower, developed in Australia was adapted to integrate and store these records, and to print QR codes used to access data, and track consignments through the supply chain.

The QR codes link to a concise summary of important details such as transport conditions (temperature, humidity, location, time), packhouse specifics, and crop-specific VietGAP records, which is required for VietGAP compliance. The QR codes also allow consumers to see basic information about that particular item, using a standard smart phone with no special software required.

This integration allowed for seamless sharing of crop data for VietGAP compliance. The process was straightforward and was easily understood by the farm staff, reducing the need for extensive training or adjustment periods.

Three cooperatives in Son La province, Tu Nhien (Natural Safe Vegetable Cooperative), Greenfarm Moc Chau, and Greenfarm Van Ho have piloted the system with AEON and Mega Market supermarkets in Hanoi, and now have the skills and tools to use digital traceability and supply chain monitoring to their advantage.

Impacts

- The integration of software tools in a cost-effective way allows farmers in Vietnam to achieve VietGAP compliant digital traceability for vegetables, which includes GPS enables temperature loggers to monitor cool chain performance in a cost effective way.
- Farmers now have the expertise and tools to combine digital tracking, temperature monitoring, and VietGAP compliance for fresh produce, opening up new markets.
- Farmers in Moc Chau are now supplying higher value products, which will receive a 40% price premium in the offseason compared to wholesale markets in Son La or Hanoi due to higher farm gate prices paid by modern retail.
- Farmers can build trust with consumers and retailers about their safe production practices and product quality.
- Consumers have access to a trusted system that can verify the safety of the vegetables they purchase from modern retail stores in Hanoi.
- Digital tools to communicate the VietGAP compliance and handling of vegetables has set a new precedent for food safety standards. There is now a higher level of traceability and transparency in the VietGAP value chains from Son La to Hanoi, which can be replicated in other supply chains.
- Less pesticide is being used because farmers only use VietGAP compliant crop protection products and also have improved knowledge about how to use them correctly.

The digital tools developed and tested by this project will have direct applicability to assuring GAP compliance of high-value fruit from Son La destined for domestic modern retail and export markets.

Conclusions

The technical feasibility and value of digital monitoring of VietGAP compliance and quality in Vietnam vegetable value chains has been successfully demonstrated. Three cooperatives in Son La are now empowered with new skills and technology to target higher value customers through improved vegetable quality and packaging.

The tools developed and adapted in this project can be adapted and upgraded to provide digital traceability and supply chain quality monitoring in fruit value chains focussed on modern retail in Vietnam, and export.

The data entry app needs to be improved to include all the data VietGAP requires, and the software developed by Hitachi requires further development to ensure it is reliable and user friendly. The information available to consumer from the QR code needs to be simplified and focus on basic crop data and the farmer.

Consumers value an assurance that the vegetables they eat are safe, and VietGAP along with labelling and quality gives them that assurance, and they are willing to pay for it.

3 Background

The opportunity

The project builds on two ACIAR projects (AGB/2009/053, AGB/2014/035) which were focussed on counter seasonal, VietGAP certified safe vegetables from Moc Chau, supplying modern retail markets in Hanoi. These projects were the primary driver for the development of a 70,000 tonne (\$30 million AUD) vegetable industry in Moc Chau, which did not exist in 2011. Prior to the ACIAR investments the primary crops were rice and maize, both low value crops.

The new value chain has grown rapidly. Farmer incomes in Moc Chau and Van Ho districts have increased up to 10-fold over the last 9 years, and spawned other projects (e.g. Aus4Equity GREAT, Aus4Innovation). There has been significant private sector investment in supplying VietGAP certified safe fruit and vegetables. Approximately 10% of new vegetable production industry in Moc Chau follows the VietGAP quality assurance protocol.

However, challenges remained, with the most significant being traceability, compliance with VietGAP and product quality along the chain.

The opportunity was to use low cost QR codes, IoT sensors, smartphones and computer platform technology to fill these gaps, and provide a solid foundation for the sustained growth of the safe vegetable industry in Vietnam. If successful, the model could then be applied to tracking QA compliance and quality of high-value fruit crops from Son La including mangoes, dragon fruit and longans.

Hitachi Vantara, Applied Horticultural Research and Hort Innovation are partners in an Australian Government funded project, administered through the Department of Agriculture, Fisheries and Forestry (DAFF), piloting digital monitoring of the environmental performance of Australian horticultural producers. This DAFF project developed a virtual 'Control Tower' which integrates sensor data on soil moisture, weather and crop performance with crop water use, nutrient leaching, soil erosion with agronomic data and crop records. The approach can provide valuable information to growers in real time on crop performance, irrigation management, crop protection as well as tracking the crop through the supply chains using GPS enabled technology¹.

The virtual control tower includes a compliance component which reports grower performance against environmental management frameworks, such as Freshcare Environmental. This compliance could be modified to report against a quality assurance system such as VietGAP, ASEAN GAP or Global GAP. It is the intention of the project team, to adapt the Hitachi-Vantara Control Tower to monitor VietGAP-certified safe vegetables in Vietnam in this project and expand to include mango and dragon fruit exports in a potential new project.

The project concept

With farmers firmly in the drivers' seat, a smartphone app was used to record the crop production data, harvest date and farmer for each consignment. QR codes printed on labels at the farm link to a database of crop production information including pesticides and fertilizers used, planting date, harvest date and variety – everything needed for VietGAP compliance.

Inexpensive GPS-enabled temperature and humidity sensors monitor the cool chain and the modified virtual control tower uses GPS and satellite imagery to build a map of the cool chain for every consignment. QR codes on labels allow consumers to see basic crop

¹Digital monitoring of the environmental performance of Australian horticultural producers
<https://ahr.com.au/digital-remote-monitoring>

and farmer information. The QR codes also allow retailers to access the more detailed traceability required for VietGAP compliance.

Farmers benefit from having a reliable traceability system to verify VietGAP compliance, and to monitor and improving cool chain conditions from packhouse to market. The system eliminates the need for the manual recording of crop data and paper records. It also results in improved product quality at retail and reduced postharvest losses. Farmers and retailers will have access to electronic crop records. A further benefit will be ready access to VietGAP support information developed as part of ACIAR projects AGB/2009/053 and AGB/2014/035.

Investigating the benefits of a potential project to develop and test a similar approach for digital traceability of major export crops in Vietnam, e.g., mangos, dragon fruit and avocados is also part of the project. That project would provide the records required by world markets which require compliance with ASEAN-GAP or Global GAP. The new digital tools include: low-cost temperature sensors, software to print QR codes specific to each consignment, a smartphone app designed to read QR codes and link to GPS data for position and time, and adaptation of the Hitachi virtual control tower for data processing and storage. The virtual control tower will also provide access to all the VietGAP requirements and training and support information that has been developed by ACIAR projects AGB/2009/053 and AGB/2014/035.

4 Objectives

4.1 Objectives and Activities

Objective 1: To pilot digital monitoring of VietGAP compliance and in Vietnam vegetable value chains in Vietnam.

- 1.1 Select 3 farmer groups from AGB/2014/035 as pilots for the digital value chain monitoring project as pilots.
- 1.2 Consult with and support pilot groups to ensure farmers are in the drivers' seat and that the project delivers outcomes that farmers value.
- 1.3 Consult with retailers to ensure the system delivers what they value.
- 1.4 Engage with DARD, MARD and DOST in Vietnam to ensure the framework is compatible with VietGAP and expandable to export crops including mangoes, dragon fruit and avocados.
- 1.5 Adapt and test the virtual Hitachi Control Tower to handle and process crop production data, supply chain tracking, pesticide residue test results, cool chain monitoring using low cost temperature sensors.
- 1.6 Develop and test the smartphone app and QR code system to track consignments and store relevant crop information for VietGAP compliance and integrate with the virtual Hitachi Control Tower.
- 1.7 Add VietGAP requirements, best practice information, effective farmer group processes and procedures developed in AGB/2014/035 as Standard Operating Procedures (SOPs) into the Control Tower and use for the three participant farmer groups.
- 1.8 Establish digital value chain monitoring pilots in three vegetable farmer groups in Moc Chau and/or Van Ho, Son La province. Supply farmers with all the necessary hardware and data capability for the pilots.

Objective 2: To develop, test and showcase the digital tools required to pilot digital monitoring of VietGAP compliance of vegetables in Vietnam.

The completion of activities related to this objective was dependant on gaining additional support from the Vietnamese government. The additional funds were never received, to the activities listed below were significantly curtailed.

- 2.1 Monitor consignments of produce from Moc Chau and Van Ho to retailers in Hanoi, assessing the accuracy of digital data, operational feasibility and useability for all value chain participants.
- 2.2 Assess the effectiveness of the digital monitoring on post-harvest quality. Assess consumer and retailer perceived value of digital traceability.
- 2.3 Assess the financial cost/benefits to farmers, retailers and other value chain participants.
- 2.4 Showcase the financial, biophysical and social benefits of digital VietGAP value chain monitoring to the domestic vegetable industry and export mangos, avocados and dragon fruit industries in Vietnam. Showcasing event to be held in Moc Chau February 2023.

5 Methodology

Objective 1: To pilot digital monitoring of VietGAP compliance and in Vietnam vegetable value chains in Vietnam.

5.1 Consultation and engagement

Selection of farmer groups

The project team short-listed farmer groups from the ACIAR project AGB/2014/035 and/or GREAT vegetable projects for pilots based on past performance and likelihood to succeed. The project team then met with each farmer group and explained the proposal to gauge interest and select three farmer groups to proceed, based on rankings of a range of criteria in an objective process, led by NOMAFSI.

The project team interviewed seven villages to understand their interest and capability of piloting a digital traceability system. The villages were selected based on their involvement in previous VietGAP projects, such as ACIAR AGB/2014/035. The following villages were interviewed:

1. Green Farm (Mr Nghiep)
2. Hoang Hai (Mr Hai)
3. Tu Nhien (Ms Luyen)
4. Dung Tien (Mr Dung)
5. An Thai (Ms Tam)
6. Mr Van (trader)
7. Ta Niet (Mr Duyen)

Three farmer groups were selected, which included two of the different governance models identified in project AGB/2014/035. The **Tu Nhien (Natural Safe Vegetable Cooperative)** is a typical Vietnamese cooperatives. **Greenfarm Moc Chau** and **Greenfarm Van Ho** is more of a commercial trader operation.

Engagement with retailers

The project concept of digital traceability was pitched to four supermarkets in Hanoi:

1. AEON
2. Big C
3. Lotte
4. Vin Echo
5. Mega Market

The project team consulted with major retailers (Big C, AEON, VinMart, Mega Market, Lotte) as well as the safe fruit/vegetable stores (Big Green, Bactom) in Hanoi as potential retail partners for the pilots. The traceability and VietGAP needs and interest in the project was discussed in each meeting. The supermarkets **AEON** and **Mega Market** were chosen as retail partners.



Engagement with Government

The project team met with DARD and the Moc Chau People's Committee to gain their support, which was forthcoming. The project team, also met with the Ministry of Science and Technology (MOST) on two occasions in February 2022 and again in February 2023. On both occasions MOST were supportive of the project and the focus on digital traceability, but gaining financial support for this project or a subsequent project focussed on fruit (e.g. AGB/2022/114) was going to be difficult.

5.2 Implementation

Digital monitoring hardware and software development

A smartphone app produced by the Nong Nghiep So company² was used to capture the crop information including farmer, crop, cultivar, pesticide applications, planting / harvest dates, required for VietGAP compliance, from three pilot farms in Moc Chau. Low cost Escavox³ GPS-enabled temperature and humidity loggers were used to track consignments and monitor conditions.

The Hitachi virtual control tower, developed in Australia⁴, was adapted to integrate and store these records, and to print QR codes used to access data and track consignments through the supply chain. The Control Tower processes crop production data, supply chain GPS tracking, cool chain monitoring and makes this available to both consumers and to retailers.

QR codes generated by the software, printed on farm and incorporated into the labelling can be scanned by consumers with any smart phone to provide basic marketing information about the crop and farmer. The same QR code can be scanned by retailers or other value chain partners to obtain the more detailed tracking information required by VietGAP.

AHR local coordinator Nguyen Thi Nga played a key role in communicating the farmers' needs back to the Hitachi design team during the development of the system to make sure it provided value to the farmers. The project team used a collaborative design process rather than a top down approach to ensure the project delivers outcomes that the farmers and their groups had buy-in, and the system was appropriate for these farmers.

Label printers, label stock and computers were provided to the farmer groups as needed to make sure they had the capacity to print labels on farm. Label designs were developed in consultation with retailers, farmers and Hitachi to make sure they were technically feasible and worked commercially.

Coolroom facilities: We also made sure each of the farmers had cool room facilities available, and a cool truck if possible. Greenfarm had a 35m³ cool room provided by the Aus4Innovation CoolBot project⁵, and we modified this to conventional cooling, funded by the project. Tu Nhien had a 35m³ cool room from the CoolBot project and we provided a 35m³ CoolBot cool room to the An Thai farmer group. Greenfarm have their own cool truck, and the other two farmer groups have Pantech-type trucks.

Establishing and supporting pilot value chains

Three digital value chain pilots were established in Moc Chau. These were the Tu Nhien cooperative, the Greenfarm cooperative Moc Chau and the Greenfarm cooperative Van Ho, supplying AEON and Mega Market in Hanoi (Figure 1).

AHR staff in Vietnam and the NOMAFSI staff worked with the farmer groups and retailers listed above. The project team made sure the farmers were engaged and contributing to system development. It was important for the farmers to have ownership of the digital tracking system, that the design works for them and adds value. In mid-2022, AHR employed Nguyen Thi Nga as a project officer based in Moc Chau to work three days per week with the farmer groups. Vu Thi Phuong Thanh was employed one day per week by AHR to work with retailers in Hanoi and review consignments on arrival to Hanoi.

² <https://www.nongnghiepsoc.com/home>

³ <https://www.escavox.com/>

⁴ <https://ahr.com.au/digital-remote-monitoring>

⁵ <https://research.csiro.au/aus4innovation/cooling-tech-enhances-value-chains-for-vegetable-farmers-in-son-la/>

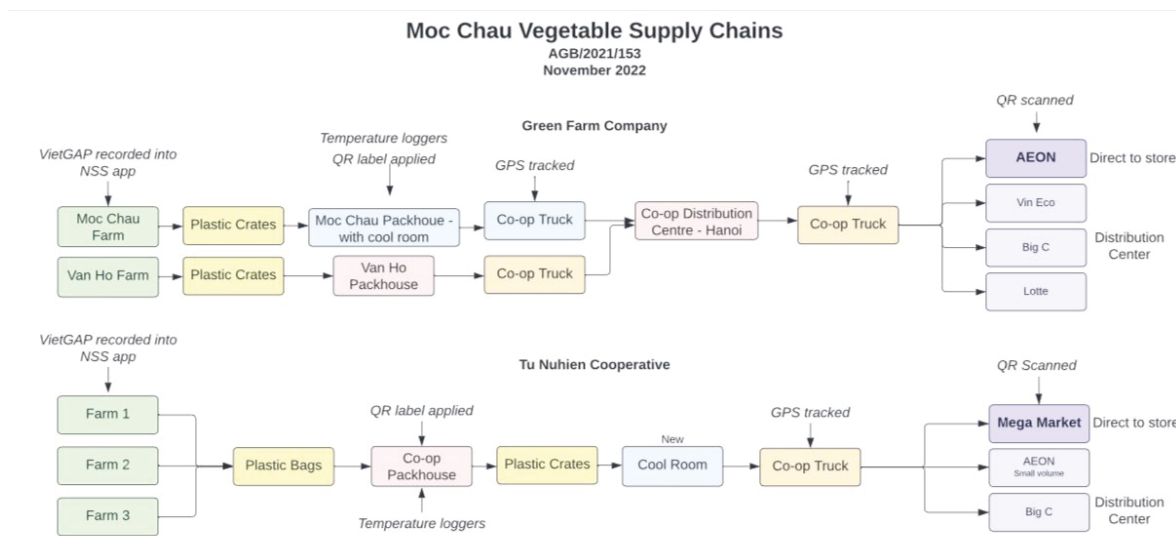


Figure 1: Concept map of three Moc Chau supply chains

A great deal of effort was put into working directly with the farmers on the design of labels, training them on using the tools, making sure quality as good. Technical support required to comply with VietGAP was provided by the project team as required. The team also worked closely with the retailers to make sure the digit traceability system was meeting their requirements and that they knew how to use it.

5.3 Promotion and showcasing

In store promotions in Hanoi

The project team tested the benefits of promoting Moc Chau produce with the new labels including QR codes in the store. A two-week in-store promotion was organised at AEON Long Bien to coincide with the Australian Senate Standing Committee on Rural and Regional Affairs and Transport tour in April 2023.

The project team consulted with the farmers and AEON staff in the preparation, design and implementation of the in store display. The banners (Figure 12, Figure 13) were designed by the project team and printed in Vietnam. Both Greenfarm and Tu Nhien supplied vegetables through AEON during the two week promotional period and beyond.

Showcasing events in Hanoi

There were two showcasing events in Hanoi. The first involved the ACIAR PAC and Commission in June 2022 when farmers visited the AEON store in Hanoi and along with retail managers demonstrated the benefits of the new traceability system, labelling and packaging.

The second event in April 2023 was prefaced by an in store promotion for approximately two weeks followed by a showcasing event lining to Australian Senate Standing Committee on Rural and Regional Affairs and Transport, led by Senator Glenn Sterle also visited an AEON store in Hanoi, viewed the project produce with QR codes and met a delegation of farmers from Moc Chau. Again, farmers from Moc Chau attended and retail staff assisted in the event.

Digital traceability in horticulture Agribusiness event in Hanoi 2023

The project was also showcased at the Agribusiness Reference Group workshop on traceability in HORT Hanoi on the 28th February 2023.

Showcasing event in Moc Chau

A project showcasing event (Figure 9) was hosted by the project in Moc Chau on the 18th of February 2023. Son La (provincial) Department of Agriculture leader Ms Lan and Moc Chau and Van Ho (district) Department of Agriculture representatives Mr Thanh and Mr Sinh attended the event. The event was also attended by AHR staff from Australia (Gordon Rogers, Henry Hyde and Liam Southam-Rogers),

5.4 Measuring impact

Monitoring of consignments from Moc Chau to Hanoi: data and feasibility

Once the pilot value chains were established and farmers provided with the tools, and trained in their use, the project team and farmer group leaders / representatives monitored consignments of produce from Moc Chau and Van Ho to retailers in Hanoi, assessed the accuracy of digital data, operational feasibility and useability for all value participants.

The effectiveness of the digital monitoring on post-harvest quality was assessed by measuring quality and temperature in the cool chain using temperature loggers and postharvest quality assessments at either end. The performance of product on retail shelves was monitored to assess the level of postharvest losses. Comments were also collected from farmer groups, retailers and consumers by the project staff.

Consumer studies in Hanoi

Focus group discussion research studies were conducted in Hanoi with customers from AEON Long Bien and MM Mega Market stores in February 2023. The research was undertaken by Ha Thi Lan Anh and Luu Duong Hop of Inmar Communications Consultancy, Hanoi. The study covered a representative range of incomes, education levels and age. The objective was to gain in-depth insights about the awareness, perception and willingness to use and pay for QR codes on vegetables and fruit from Moc Chau.

A total of 41 consumers from various urban districts in Hanoi and regular customers at Mega Market and AEON were screened and selected to participate in the focus group studies. Four separate focus group studies were conducted. Consumers filled out pre-screening surveys individually. Once selected, consumers joined a 2-hour focus group with 10 participants per session. Participants were divided into 4 teams to do the exercise, discuss and share feedback. Products from Moc Chau, Da Lat and Red River Delta were used for consumers to observe, experience QR code and share insights.

Pilot value chain studies post-harvest quality and cost:benefit studies

The benefits of a well-managed cool chain on vegetable quality is well established, and does not need to be repeated. However, the project team in Vietnam undertook some supply chain monitoring to confirm these benefits and cool chain management using temperature loggers during hot weather. Farmers are reluctant to use cool rooms during cool weather.

The financial cost/benefits to farmers, retailers and other value chain participants was assessed at the same time as the supply chain monitoring. Value chain assessment tools were used, essentially measuring costs and benefits, including reduction in postharvest losses, health benefits to consumers from VietGAP certified produce and any social benefits to farmer households.

Legal agreements

AHR contracted Hitachi Vantara in a scope of works agreement to develop an application for supply chain digital monitoring of VietGAP compliance for AHR for use in Vietnam.

The application is containerised so that it can run on different platforms. The intention is for the application to be hosted on Hitachi's Horticulture Control Tower. However, the

application and related code has been made available to AHR in a suitable compatible format with instructions for use within a hosting service such as GitHub or equivalent, to enable AHR to run the application on alternative platforms in Vietnam. AHR and its approved users are free to modify and/or adapt the application for future use.

This agreement means the application and its code is essentially open source and can be modified and used in any way we wish in this project or future projects, such as the digital traceability fruit project. The Scope of Works is included as Appendix 4.

6 Achievements against activities and outputs/milestones

Objective 1: To pilot digital monitoring of VietGAP compliance and in Vietnam vegetable value chains in Vietnam

No.	Activity	Outputs/ milestones	Completion date	Comments
1.1	Select 3 farmer groups from AGB/2014/035 as pilots for the digital value chain monitoring project as pilots.	Farmer groups selected	April 2022	Three farmer groups were selected: Tu Nhien Cooperative, Greenfarm Moc Chau and Greenfarm Van Ho. These groups were selected after a formal, documented selection process including visits and interviews in April 2022.
1.2	Consult with and support pilot groups to ensure farmers are in the drivers' seat and that the project delivers outcomes that farmers value.	Farmer groups selected and support provided throughout the project.	March 2023	There was ongoing close contact between the project team and the selected farmer groups in Moc Chau throughout the project. The farmer requirements from the digital traceability system were discussed and agreed. The Nong Nghiep So recording app was incorporated into the system. Project staff in Moc Chau worked closely with farmers at all stages of the project to ensure it met their needs.
1.3	Consult with retailers to ensure the system delivers what they value.	The initial retailer consultation was completed and two retailers were selected. Ongoing consultation with retailers and consumer studies completed.	March 2023	Five retailers (AEON, Mega Market, Lotte, Big C, Big Green) were interviewed in Hanoi in April 2022. Two were selected (AEON, Mega Market). There has been ongoing consultation, discussions and face to face meetings between retailer staff, project staff, and the farmers especially in relation to labelling, packaging and supply.
1.4	Engage with DARD, MARD and MOST in Vietnam to ensure the framework is compatible with VietGAP and expandable to export crops including mangoes, dragon fruit and avocados.	Multiple meetings and ongoing communications with MOST, Moc Chau district government and DARD and MARD	March 2023	Two meetings held with Mr Dam Quanh Minh, Principal Official leading the Division of Agriculture within MOST (Ministry of Science and Technology) in April 2022 and February 2023. Multiple meetings with Moc Chau PC and DARD, ACIAR Vietnam staff. Refer trip reports for details (Error! Reference source not found.). Subsequent meetings with DARD and fruit farming cooperatives in Son La, Mai Son Yen Chau and Moc Chau.
1.5	Adapt and test the virtual Hitachi Control Tower to handle and process crop production data, supply chain tracking, pesticide residue test results, cool chain monitoring using low cost temperature sensors.	Software completed and delivered as an operating module and also as code. Ownership of software vests with ACIAR.	December 2022	The Hitachi Control Tower was integrated with the digital record system <i>Nong Nghiep So</i> and the consignment monitoring system <i>Escavox</i> . Software linking the Nong Nghiep So app, Escavox loggers to provide GPS tracking and VietGAP compliance information completed delivered in the software container GitHub.

No.	Activity	Outputs/ milestones	Completion date	Comments
1.6	Develop and test the smartphone app and QR code system to track consignments and store relevant crop information for VietGAP compliance and integrate with the virtual Hitachi Control Tower.	Nong Nghiep So app used and integrated with the software described in 1.5	December 2022	A consignment management system was developed within the Control Tower, which can print unique QR codes for each consignment and allow retailers or consumers to view live consignment data. Consumer and retailer access via the QR code. Feedback from the retailers was excellent for the system. Requires a computer a printer in the packhouse, with access to data via a smart phone.
1.7	Add VietGAP requirements, best practice information, effective farmer group processes and procedures developed in AGB/2014/035 as Standard Operating Procedures (SOPs) into the Control Tower and use for the three participant farmer groups.	-	-	To add this functionality onto the system proved to be beyond the scope of the project in its current form. The system as designed still works well and provides the necessary traceability and record keeping functionality that is required. Accessing the VietGAP data could be added in the future if required.
1.8	Establish digital value chain monitoring pilots in three vegetable farmer groups in Moc Chau and/or Van Ho, Son La province. Supply farmers with all the necessary hardware and data capability for the pilots.	Tu Nhien Cooperative are supplying Mega Market. Green Farm Moc Chau and Green Farm Van Ho are supplying AEON.	March 2023	Three pilot smart vegetable value chains were established from September 2022. Tu Nhien Cooperative is supplying into Mega Market. Green Farm Moc Chau and Green Farm Van Ho are supplying into AEON. Farmers were supplied with high quality label printers, new computers, Escavox trackers and redesigned premium produce labels.

PC = partner country, A = Australia

Objective 2: To develop, test and showcase the digital tools required to pilot digital monitoring of VietGAP compliance of vegetables in Vietnam

No.	Activity	Outputs/ milestones	Completion date	Comments
2.1	Monitor consignments of produce from Moc Chau and Van Ho to retailers in Hanoi, assessing the accuracy of digital data, operational feasibility and useability for all value chain participants.	The three pilot value chains have been evaluated and are continuing to operate.	March 2023	A local coordinator was appointed to manage consignments and ensure accurate data was provided in the digital records. NOMAFSI provided VietGAP compliance training to new farm staff to ensure correct pesticides and withholding periods were used.
2.2	Assess the effectiveness of the digital monitoring on post-harvest quality. Assess consumer and retailer perceived value of digital traceability.	Consumer study complete. Temperature and relative humidity in loads monitored and available to growers and retailers via the QR code.	March 2022 for consumer and temperature studies. The postharvest retail assessments incorporated into AGB/2022/114	Consumer research was undertaken by Fresh Studio in April 2022 to understand the perceived value of digital VietGAP traceability systems. Postharvest retail assessments were postponed to summer 2023 as farmers do not use refrigeration in the cool months, and the Control Tower was not ready in Summer 2022. Follow up studies incorporated into project AGB/2022/114.
2.3	Assess the financial cost/benefits to farmers, retailers and other value chain participants.	Combined with the retail assessments.	-	Combined with the postharvest retail assessment. We incorporating this activity into the AGB/2022/114 project.
2.4	Showcase the financial, biophysical and social benefits of digital VietGAP value chain monitoring to the domestic vegetable industry and export mangos, avocados and dragon fruit industries in Vietnam. Showcasing event to be held in Moc Chau February 2023.	One showcasing event in Moc Chau, two high level showcasing events in Hanoi, and a presentation at the Agribusiness Reference Group workshop on traceability in HORT in Hanoi.	April 2023	A showcasing event was held in Moc Chau in February 2022 that included Son La provincial and district level directors. The project was also showcased at the Agribusiness Reference Group workshop on traceability in HORT Hanoi on the 28th February 2023. Further to the above events, the project was showcased in Hanoi to the ACIAR PAC and Commission in June 2022 which included a visit to the AEON store in Hanoi, viewing the Moc Chau safe produce and meeting a delegation of Moc Chau farmers. A separate event was run in April 2023. When the Australian Senate Standing Committee on Rural and Regional Affairs and Transport, led by Senator Glenn Sterle also visited an AEON store in Hanoi, viewed the project produce with QR codes and met a delegation of farmers from Moc Chau.

PC = partner country, A = Australia

7 Key results and discussion

7.1 Farmer Capacity Building

Three cooperatives: Tu Nhien (Natural Safe Vegetable Cooperative), Greenfarm Moc Chau, and Greenfarm Van Ho undertook record keeping training for VietGAP. This aimed to give farmers and key staff an understanding of what is required for compliance with the VietGAP protocol, and to showcase best practices to retailers and consumers.

Each packhouse was supplied with the tools and equipment required to implement the digital traceability system being developed by the project team. These included a label printer (Zebra ZT230), a computer for data management, Escavox trackers for live location updates, and a subscription to the Vietnamese digital record-keeping software, Nong Nghiep So. These resources would enable them to maintain proper digital records, track shipments accurately, and create labels for products swiftly and accurately.

In terms of infrastructure, notable upgrades were made to the cooperatives' facilities. Tu Nhien received a new cool room, equipped with a CoolBot refrigeration unit, to ensure optimal temperature control for storing perishable goods. Greenfarm underwent a significant upgrade, where the CoolBot unit in its cool room was replaced with a conventional cooling system, providing more robust and efficient cooling.

New large, waterproof labels were designed for both Greenfarm and Tu Nhien, in close collaboration with the farmers. The labels can withstand adverse weather conditions or condensation from refrigeration, and are big enough to incorporate essential product details, a barcode for scanning, and a QR code for direct access to digital information.

The cooperatives were given extensive training on digital record-keeping which equipped them with the necessary skills and understanding to manage their data digitally, promoting efficiency, and enhancing data accuracy.

As part of an initiative aimed at connecting cooperative leaders with the marketplace, the leaders were invited to visit Hanoi. They had the opportunity to interact with retailers and see their produce displayed. During the project, each farmer visited supermarkets in Hanoi at least three times, meeting with fresh produce category managers who purchase their produce. These encounters enabled the farmers to better understand the retail environment and experience the journey of their farm produce firsthand.



Figure 2: Commercial grade Zebra printers supplied to Tu Nhien and Greenfarm

7.2 Digital Traceability Software

Hitachi Vantara was tasked with the development of a complete VietGAP compliance system. The objective was to create a system that could provide real-time information via a comprehensive dashboard. This platform would allow consumers and retailers to access crop-specific VietGAP records and traceability data, significantly enhancing transparency and accountability.

To ensure the system would meet the needs of its primary users, two key groups were surveyed: retailers and cooperative leaders. The retailers included significant market players such as AEON and Mega Market. Their input was sought to understand their specific requirements from a digital record system. The survey aimed to gather information on desired features, usability preferences, and data requirements that would help streamline their business operations and facilitate informed purchasing decisions.

Similarly, leaders from three cooperative organisations were consulted to better comprehend their needs and expectations from a digital record system. The consultation revealed that all three cooperatives were already familiar with the Nong Nghiep So digital record keeping system.

Recognising this existing familiarity, Nong Nghiep So was invited to join the project. Hitachi then developed an Application Programming Interface (API) for data sharing between the Nong Nghiep So app and Hitachi's Control Tower.

An API is a set of rules that allows different software applications to communicate with each other. When one application wants to access a feature or data from another application, it sends a request to the API. The API processes this request and sends back the relevant data or a status update. Essentially, an API serves as a middleman between applications, enabling them to interact without needing to know how each one is implemented.

This integration allowed for seamless sharing of crop data for VietGAP compliance. The process was straightforward and was easily understood by the farm staff, reducing the need for extensive training or adjustment periods.

To provide the GPS tracking as well as the capacity to monitor temperature and humidity on farm and in consignments, Escavox trackers⁶ were sourced from Australia and supplied to the cooperatives. These devices track and share location data to the Hitachi Control Tower via an API, providing real-time updates on the whereabouts of cooperative trucks.

Hitachi's Control Tower generates a unique QR code for each consignment. The QR codes link to a concise summary of important details such as transport conditions (temperature, humidity, location, time), packhouse specifics, and crop-specific VietGAP records.

In the final phase, retailers were given access to the Control Tower, enabling them to see detailed VietGAP records. This includes vital information like pesticide application dates, harvest dates, packing dates, tracking data, and transport storage conditions. The digital system also offers an alternative for consumers, who can easily scan the QR code to view a summary of the VietGAP data, enhancing their understanding of the food they consume and supporting informed purchasing decisions.

Examples of data the system records

Figure 3 shows the data that has been entered by the farmer using the Nong Nghiep So app. You can see data such as the farm, crop, harvest date. Other data is provided as well such as pesticide usage, variety etc. This data is provided for each consignment and

⁶ <https://www.escavox.com/>

is accessed via a QR code. The supermarket has a higher level of access and can see more data than the consumer.

Figure 4 is an example of the GPS tracking module, showing the track in real time as well as temperature and humidity during the journey. Clicking on the track will bring up the temperature and humidity at that point, and the time. The numbers in red next to the dots are temperatures (°C).

The shaded colours on the graph show different stages of the journey. The yellow is on farm and in the cool room, grey is in the truck and pink is at the distribution centre or store. The black line is relative humidity.

More details on the functionality of the software are outlined in the Appendix 10.

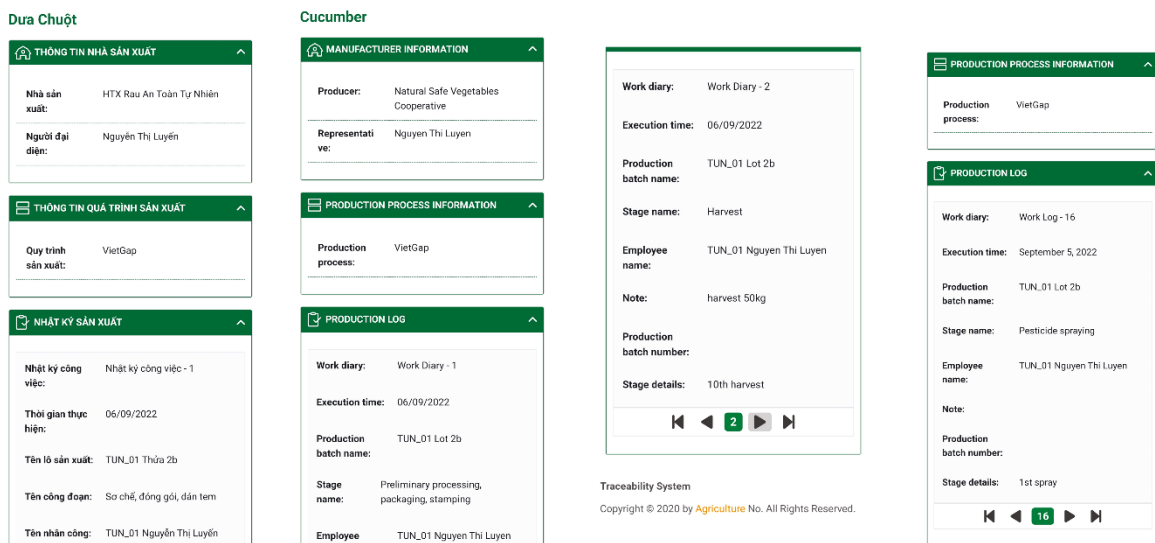


Figure 3: Nong Nghiep So VietGAP record system

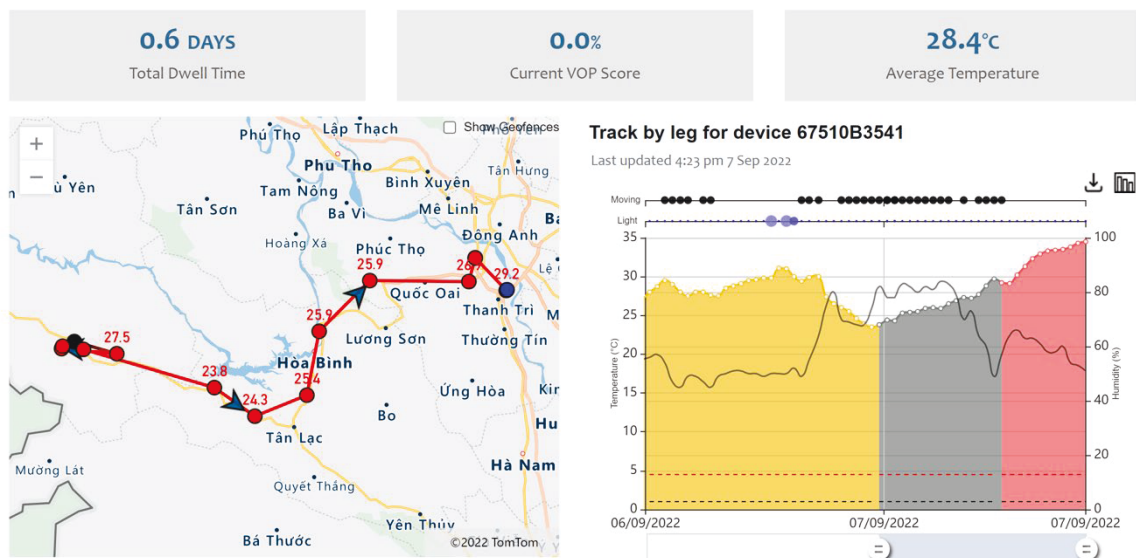


Figure 4: Escavox location and temperature tracking

7.3 Labels and QR Codes

New labels were required so that QR codes and product information could be printed. New produce labels were designed for Tu Nhien and Greenfarm after consultation with the cooperative leaders and fresh produce managers at Mega Market and AEON Supermarkets. Labels from Dalat vegetable suppliers were seen as a benchmark.

The cooperative's had the following requirements for the labels:

- Large and colourful
- Waterproof (for use with refrigeration)
- White space to print information and QR codes
- Prominent branding

The retailers had the following requirements for the labels:

- Barcode printed on the label
- Detailed product information on the label

A local graphic designer was hired to prepare label designs for each cooperative's approval. 100 000 labels (Figure 5) were provided to each of the cooperatives in October 2022. Label dimensions are 5cm wide by 7cm high.

You can scan the QR code on the label to the right, and you will see the crop records come up.



Figure 5: New labels designed for Greenfarm and Tu Nhien

7.4 Consumer Research

Four focus group discussion research studies were conducted in Hanoi with customers from AEON Long Bien and Mega Market stores in February 2023. The research was undertaken by Ha Thi Lan Anh and Luu Duong Hop of Inmar Communications Consultancy, Hanoi. The study covered a representative range of incomes, education levels and age, as described in the methodology section.

The first series of questions were around the importance of traceability information and VietGAP compliance certification on vegetables, and the willingness of consumers to pay for this. There was a very clear message that consumers highly value certification. In the study 92% of consumers said they want the traceability information on the packaging including QR codes, and 58% said they were willing to pay a premium for vegetables with certification on packaging (Figure 6).

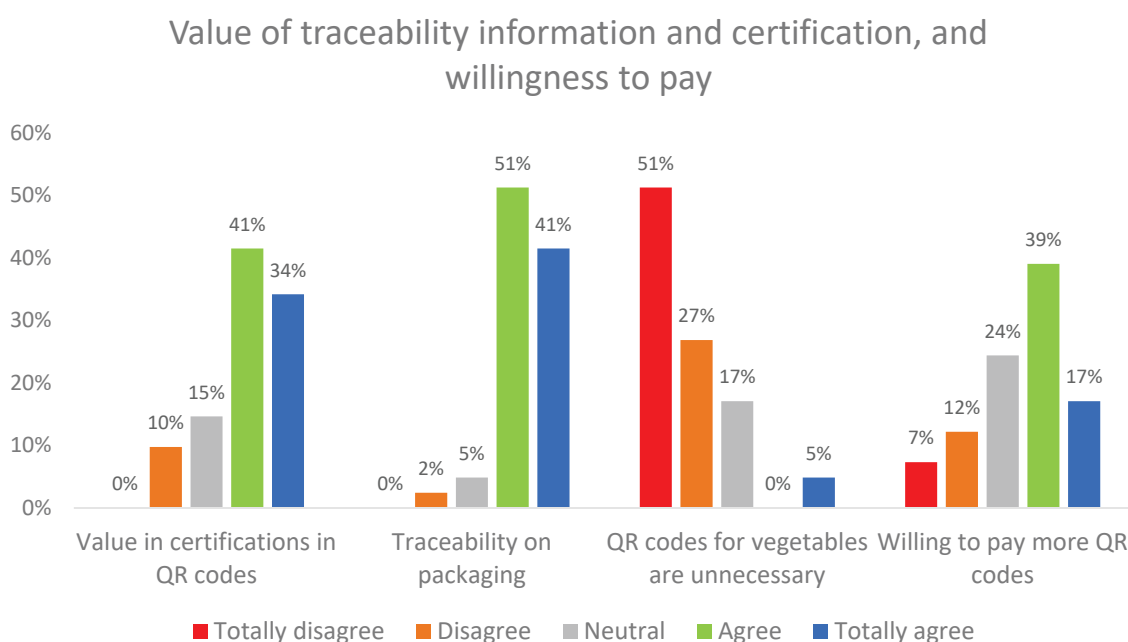


Figure 6: Consumer attitudes to traceability information including QR codes on vegetable packaging

Packaging and labels are important to consumers. 95% of consumers said they want labels included in the packaging and the same 95% want these labels to include certification information. When asked about using QR codes to convey information, 80% of respondents thought this was a good idea (Figure 7).

Labelling and packaging: what sort of information to include

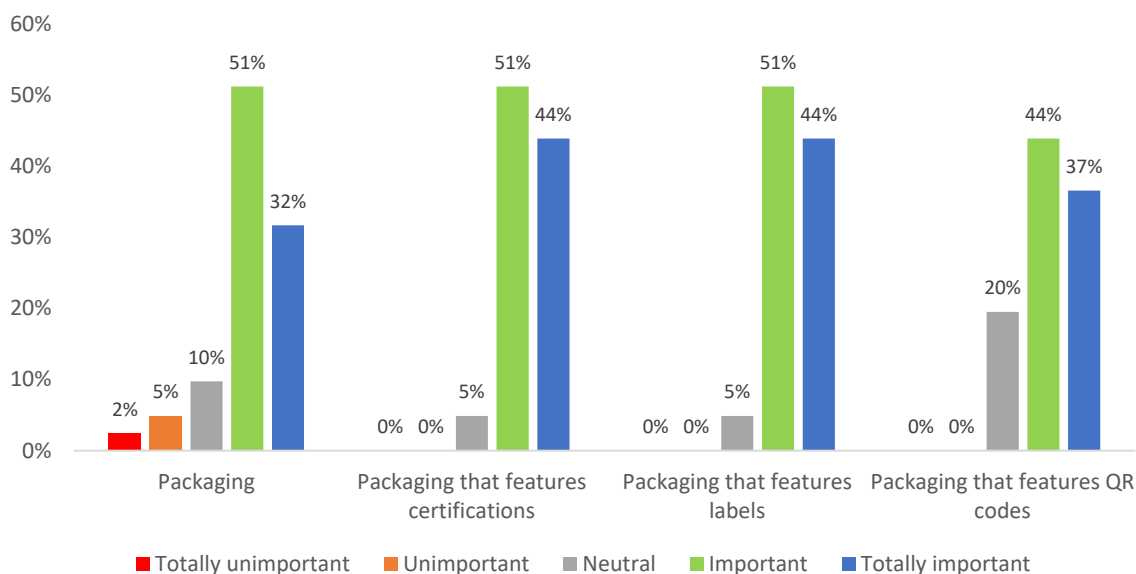


Figure 7: Packaging consumer study results

Specific feedback on the pilot value chains

Greenfarm's label and QR codes are preferred over those of the Tu Nhien cooperative due to their attractive design and size, allowing for easy scanning. However, some products face issues with wet and damaged packaging, making QR code scanning impossible. Consumers find Greenfarm's QR code information informative but lacking key details like expiry dates. They also express concerns about the longer customer journey and prefer fewer steps and clicks.

Greenfarm's packaging was well received, but for products like pepper, consumers recommend a mix of colours and suggest considering the premium and professional packaging of Da Lat Hasfarm.

Tu Nhien Cooperative's QR codes receive less positive feedback from consumers due to small labels and confusing information in both English and Vietnamese. Consumers desire shorter, consumer-focused information and improvements in packaging for cabbage and potatoes, as labels may fall out or be obscured by soil.

Consumers perceive Da Lat brands such as Vietfarm and Hasfarm to have professional, well-designed packaging with suitable information. However, the main concern is the higher price associated with these brands.

QR codes of Red River Delta products from Viet Hung and Yen Phu Cooperatives are considered less accessible and attractive than Greenfarm's, but better than those of Tu Nhien Cooperative. However, they may still face challenges with small labels that are difficult to scan.

Key insights on behaviour, attitude and willingness to pay in relation to QR codes on product labels

Consumers consider certification, brand names, expiry dates, and production regions to be important information. If these details are already on the labels and the products are sold in supermarkets with quality control, QR codes are seen as nice to have, but not necessary.

Consumers appreciate the information provided by QR codes, but they also have concerns and challenges in using them. These include slow internet speed, small or

damaged labels due to wetness, labels placed inside products that are difficult to scan, elderly consumers who do not usually use phones, and the busy nature of shopping which makes scanning QR codes inconvenient.

QR codes are considered more useful for fresh products like tomatoes, cucumbers, and fruits with thin skin. They are perceived to be less important for root vegetables, cabbage, and plums, as these are believed to have less pesticide spraying.

When scanning QR codes, consumers prefer to see information such as the production region, packing house, weight of the product package, expiry dates, and certification. They also appreciate links to the company's website and introductions to other products. However, they do not want to see information about which farmers grew the products or technical management details. They prefer short and precise information as they are pressed for time while shopping.

Consumers are willing to scan QR codes the first time they encounter a product. Once they are familiar with the product and brand, they don't see the need to scan it again. QR codes are considered useful, but the products themselves must look fresh.

The majority of consumers are not willing to pay extra for QR codes because they believe the producers and retailers should cover the costs. They view QR codes as nice to have but not essential, especially when certification and brand information are already available on the packaging. However, a few consumers are willing to pay between 1,000 to 3,000 VND/kg for QR codes to be included on the products.

A detailed consumer research report is attached as an Appendix 1.

7.5 Enhanced Supply Chains and Improved Quality

Feedback from the in country project coordinator (Nguyen Thi Nga)

These are some changes in the farmers practices in relation to quality, packaging and labelling we have observed due to project activities.

Labelling: Both Greenfarm and Tu Nhien are using the label templates developed by the project team in collaboration with store buyers.

Packaging: During the promotion at the Aeon store, the pilot farmers were encouraged to observe and learn from the packaging methods used by other suppliers. As a result, the Tu Nhien Cooperative invested in a film wrapping machine and developed multiple types of packaging.

Nga provided on-ground information to app designers and also trained and assisted farmers in using the application. Once the system was set up, she helped to incorporate the labels necessary information into the farm production systems. She also encouraged suppliers to introduce the traceability system to their other customers.

Benefits for the Farmer Cooperatives: The traceability system is tangible evidence of the activities farmers undertake in the field. Ms. Hien from the Tu Nhien Cooperative said "the system has made a significant impression on their clients, especially new ones". "It's proving to be a valuable tool for suppliers to present to their clients".

Success stories / case studies from Nga:

Vietnam National University of Agriculture: In March 2023, the Vietnam National University of Agriculture (VNUA) hosted a meeting in Moc Chau on digital technology. Topics included technology transfer, social services, and training of human resources in agronomy, particularly in the context of the fourth industrial revolution. This event drew participants and interested parties from many provinces.

The Tu Nhien Cooperative was allocated a space to showcase their vegetables at the event. Ms. Luyen presented their traceability system to the audience, who could scan a QR code to learn more details. The presentation was so effective that not only were all the

displayed vegetables sold, but they also had to harvest and supply additional produce to meet the demand.

Strawberries with QR Code Labels: During the 2022-2023 season, Ms. May, a farmer affiliated with the Tu Nhien Cooperative, cultivated strawberries and utilized labels containing QR codes provided by the cooperative. The majority of her strawberries were sold directly to consumers in Hanoi. The QR codes displayed the production history and her contact number, enabling many customers to reach out to her directly and place orders for her strawberries. This innovative method significantly contributed to her income for the season.

Feedback from the Tu Nhien cooperative

The Tu Nhien cooperative (Natural Safe Vegetable Cooperative) implemented the diary app and traceability system (which includes the Digital Agriculture and Hitachi systems) into their production and management practices.

Project level feedback: We found the project content extremely useful, not only for the Tu Nhien Cooperative, but also for other units involved in the production management process. It is crucial for cooperatives to provide consumers with transparent information about production to comply with VietGAP and add value. During the introduction of the digital diary app and the cooperative traceability system, Tu Nhien received enthusiastic support from the project staff. The project provided the cooperative with a Zebra ZT230 thermal stamp printer, a computer, design and printing support for 200,000 stickers, tracking devices, and product promotion.

Traceability System feedback:

1. Nong Nghiep So app

Advantages: The system is easy to use, and the cooperative has had prior experience with the app.

Disadvantages: The app lacks certain content that the cooperative needs, such as logs for pesticide usage, composting organic fertilizers, purchasing and usage of chemical fertilizers, and seed applications, as well as purchase and distribution records. Some entries still had to be manually entered by farmers, such as pesticide names, rates, and active ingredients when logging sprays. When scanning the QR code, the log section does not display on a single page, but requires toggling between pages.

2. Hitachi System

Advantages: The system can be linked to devices to track the journey, temperature, and humidity. When scanning the QR code on the label, the log section is displayed on a single page, making it easy for consumers to view retrieved information.

Disadvantages: The system's stability is not high. The system encounters issues during holidays, and there's a lack of local support.

3. QR codes on the label

Having a QR code on the label allows for the retrieval of substantial product information. Although consumers do not yet pay much attention to this, we believe that this will become a trend in the near future and it provides a marketing advantage for us.

Going forward, we propose that the project continues to add the following content to the retrieval system and digital diary: Records of pesticide usage, composting, chemical fertilizer purchases and usage, seed purchases and usage, and logs of product purchase and distribution.

Feedback from the retailers

The digital traceability tools, marketing strategies, and connections with farmers have led to improvements in the three supply chains. After the successful visit of Australian

Senators to the Fresh Market in April 2023, Tu Nhien began supplying vegetables to AEON Supermarkets.

The resilience of supply chains has been bolstered by the installation and upgrading of cool rooms. Packhouses now have the ability to store vegetables, particularly during their counter-season supply period from May to August, which helps farmers meet orders. However, we still think supply needs to be increased because some orders are going unfilled.

The produce presentation has also been enhanced with large, colourful, and waterproof labels. While the quality of produce has improved, close attention to quality and supplying orders in full will help build the businesses all round.



Volumes and quality of VietGAP certified vegetables:

The quality of vegetables supplied using a cool chain approach, pre-cooling on farm, and then transporting in a cool truck has a clear and proved benefit in shelf life and quality. These benefits are established fact and do not need to be re-established in projects such as this one.

Table 1. Typical shelf life improvements in temperature sensitive vegetable crops ^{7 8 9 10}

Crop	Shelf life at room temperature	Shelf life with a cool chain
French Beans	3-5 days	7-10 days
Broccoli	1-2 days	7-14 days
Tomatoes	1 week (if fully ripe)	2 weeks (if stored at about 12°C)
Lettuce	3-7 days	10-14 days

It is important to keep in mind that precise shelf life can vary due to many factors including the specific variety of produce, growing conditions, harvest time, post-harvest treatment, packaging, and refrigeration temperatures and conditions.

The project team in Vietnam will undertake supply chain monitoring to confirm these benefits and the operation cool chain management using temperature loggers during hot weather (June – August). Farmers are reluctant to use cool rooms during cool weather, and the system was not operational in summer 2022.

The actual supply of VietGAP certified vegetable through the pilot value chains is continuing (June 2023) despite the project officially ending in March 2023.

⁷ Thompson, J.F., Mitchell, F.G., Rumsay, T.R (2008) Commercial Cooling of Fruits, Vegetables, and Flowers. University of California Agriculture and Natural Resources.

⁸ Kader, A. (2002). Postharvest Technology of Horticultural Crops. University of California, Agriculture and Natural Resources.

⁹ Suslow, T. and Cantwell, M. (2009). Tomato: Recommendations for Maintaining Postharvest Quality. Department of Plant Sciences, University of California, Davis.

¹⁰ Boyette, M. D., Estes, E. A., Sanders, D. C., and Ware, G. O. (1992). Postharvest Cooling and Handling of Green Beans and Field Peas. North Carolina State Extension Publications.

8 Impacts

8.1 Scientific impacts – now and in 5 years

Integration of software tools in a cost effective way that allows farmers in Vietnam to achieve VietGAP compliant digital traceability for vegetables, which includes GPS enabled temperature loggers to monitor cool chain performance.

These new tools can be used to further develop domestic safe fruit and vegetable value chains and expand into export markets.

8.2 Capacity impacts – now and in 5 years

Farmers now have the expertise and tools to combine digital tracking, temperature monitoring, and VietGAP compliance for fresh produce. Pilot farmers have new capital equipment such as label printers, computers and refrigeration which supports their transition into the premium safe vegetable market.

There is now increased competition when accessing safe food retail markets in Hanoi, therefore it is important for individual brands to be well presented and of high quality. Green farm and Tu Nhien now have more resilient supply chains, with digital VietGAP and traceability data available to retailers and packhouses.

Greenfarm and Tu Nhien cooperatives are now more competitive with products from Dalat, which still attract a premium over Moc Chau vegetables. Closing the gap to Dalat fruit and vegetables should be a focus of future work, as there is an untapped potential price premium for well-produced Son La products. As an example, the Tu Nhien cooperative is now supplying AEON after an in-store promotion was organised by the project.

NOMAFSI trained new staff at Greenfarm in VietGAP methods and reporting requirements after it was found that incorrect chemicals were being recorded.



Figure 8: Ms Hien (Tu Nhien) with her first shipment of tracked produce

8.3 Community impacts – now and in 5 years

8.3.1 Economic impacts

Tu Nhien has increased their customer base to include AEON and Mega Market supermarkets. Greenfarm and Tu Nhien have been supplied with new capital equipment, which will allow them to supply higher quality and better presented vegetables.

Greenfarm and Tu Nhien are now supplying higher value products, which will receive a 40% price premium in the offseason compared to wholesale markets in Son La or Hanoi due to higher farm gate prices paid by modern retail¹¹.

¹¹ Improving livelihoods in Myanmar and Vietnam through vegetable value chains (AGB/2014/035) <https://www.aciar.gov.au/project/agb-2014-035>

Farmers can build trust with consumers and retailers about their safe production practices and product quality.

Farmer groups who adopt the system will have access to higher value markets in modern retail that require VietGAP certification and verification and cost effective tools to help them achieve this goal.

8.3.2 Social impacts

Consumers have access to a trusted system that can verify the safety of the vegetables they purchase from modern retail stores in Hanoi.

Supermarket customers in Hanoi have improved access to certified VietGAP safe vegetables, and now have a greater level of trust in the safety of the food they consume.

Digital tools to communicate the VietGAP compliance and handling of vegetables has set a new precedent for food safety standards. There is now a higher level of traceability and transparency in the VietGAP value chains from Son La to Hanoi, which can be replicated in other supply chains.

8.3.3 Environmental impacts

Greenfarm and Tu Nhien now have upgraded cooling facilities, which will allow them to store and transport vegetables over longer timeframes. Improved postharvest storage reduces the amount of food waste, which can be as high as 30% in non-refrigerated supply chains.

Less pesticide is being used because farmers only use VietGAP compliant crop protection products and also have improved knowledge about how to use them correctly. The VietGAP approved chemicals are safer and less toxic than the older pesticides that are commonly used outside of the VietGAP standard.

8.4 Communication and dissemination activities

8.4.1 Showcasing event in Moc Chau February 2023

A project showcasing event (Figure 9) was hosted by the project in Moc Chau on the 18th of February 2023. Son La (provincial) Department of Agriculture leader Ms Lan and Moc Chau and Van Ho (district) Department of Agriculture representatives Mr Thanh and Mr Sinh attended the event.

Over 30 people attended to the showcasing event, which included government officials, project cooperatives, other local cooperatives, traders and local researchers from both the fruit and vegetable sectors in Son La province.

The event included presentations from NOMAFSI, Hitachi and Applied Horticultural Research, which were followed by live demonstrations of the Hitachi Control Tower and printing of QR codes on to labels.

There were displays of digitally traceable produce from the project pilot farms of Greenfarm and Tu Nhien, as well as the leaders and staff from both cooperatives. The cooperative members then explained how the system worked and showed their labelled produce to attendees. The quality of the vegetable was excellent, as can be seen in the photos (Figure 9).



Figure 9: The Moc Chau showcasing event in February 2023

8.4.2 In-store promotions of Moc Chau produce in Hanoi

The project team tested the benefits of promoting Moc Chau produce with the new labels including QR codes in the store. A two-week in-store promotion was organised at AEON Long Bien to coincide with the Australian Senate Standing Committee on Rural and Regional Affairs and Transport tour in April 2023.

The project team consulted with the farmers and AEON staff in the preparation, design and implementation of the in-store display. The banners were designed by the project team and printed in Vietnam. Both Greenfarm and Tu Nhien supplied vegetables through AEON during the two-week promotional period and beyond.

The interaction between the farmers and the retailers was a benefit to all. As a result of the in-store promotion, the Tu Nhien cooperative became a supplier to AEON after the promotional period, whereas previously, they were only supplying Mega Market (Figure 10). The store staff were positive about the promotion as it raised the profile of Moc Chau produce and showcased the new labelling.

The sales volumes of Moc Chau vegetables from the AEON store increased by 23% over the promotion period. The cost to rent promotional space was 15 000 000 VND (\$950 AUD) for the two week promotion, which was paid the project. Another in-store promotion is planned for MM Mega Market in July 2023, as part of ongoing support for the Moc Chau vegetable growers.



Figure 10: Produce at MM Mega Market supplied by Tu Nhien, now a new supplier as a result of the in store promotion

8.4.3 ACIAR PAC and Commission visit to Hanoi June, 2022

The ACIAR PAC and Commission and Moc Chau farmers visited the AEON Long Bien store in Hanoi (project pilot store) and along with retail managers to see the benefits of improved packaging, labelling and digital traceability first hand.

The delegates were impressed by the quality of the VietGAP certified Moc Chau produce. They also met with farmers benefitting from the ACIAR-funded project helping rural communities grow safe vegetables that are then sold in high-value markets, dramatically increasing household incomes.

The visit was a good opportunity for the farmers to talk directly with the AEON buyers on their requirements and how to improve. One key issue mentioned was the need for more attractive packaging and labels which have useful information about the crop, harvest date, origin and the farmer. They also wanted QR codes for crop information and bar codes for scanning at the register.



Figure 11 ACIAR CEO Andrew Campbell, National Farmers Federation president and ACIAR Commission Chair Fiona Simpson, PAC President Prof Wendy Umberger with Moc Chau farmers Mr Duyen and Ms Luyen are holding their products at AEON supermarket, Hanoi in June 2022.

8.4.4 Australian Senate Standing Committee on Rural and Regional Affairs and Transport tour in April 2023

In April, the Australian Senate Standing Committee on Rural and Regional Affairs and Transport Participants (5 Australian Senators, 2 DAFF staff and 10 ACIAR staff and partners including farmers) visited one of the project pilot stores (AEON, Long Bien) on the 11th April 2023.

Four farmers travelled down from Moc Chau to attend the visit by the Australian Senate delegation. These were Dr Nghiep (Greenfarm), Ms Luyen (Tu Nhien), Mr Duyen (Ta Niet) and Ms Tam (An Thai) (Figure 12, Figure 13).

The delegation were looking for first-hand relevant experience of Vietnamese market access, food access and safety, and reflect the different realities and challenges of complex food systems in Vietnam. There was excellent interaction between the delegates farmers, retail staff and AHR project staff. Nguyen Thi Nga took the lead in organising the store visit and bringing farmers to Hanoi. Nguyen Thi Nga and previous project lead Dr Nguyen Thi Hung both gave a presentation to the delegation about this project and the previous project (AGB/2014/035) before the visit.



Figure 12: Australian Senate committee and Moc Chau farmers at the AEON in-store promotion, April 2023



Figure 13: Australian Senate committee and Moc Chau farmers at the AEON in-store promotion, April 2023

8.4.5 Agribusiness forum in digital traceability in Horticulture in Hanoi

The project was promoted at an Agribusiness forum in Hanoi on the 28th February 2023. The event was attended by approximately 40 in the room plus over 300 on line. The Agribusiness Reference Group Coordinator in Hanoi Mr Lam, and ACIAR Vietnam Team organised the event. Project staff member Nguyen Thi Nga presented a paper on the project entitled *Piloting digital monitoring of VietGAP compliance and quality in Vietnam vegetable value chains*.

The objective of the workshop was to share some results of the project concerning the usage of digital tools in the management of agro-product value chains.

Nguyen Thi Nga gave a presentation entitled "Pilot digital monitoring of VietGAP compliance and quality control in Vietnam's vegetable value chain" about this project.

Nga described the project activities, including creating an electronic recording application for farmers to fill in the information regarding production on the field; the Escavox™ loggers that measures temperature, humidity and provide GPS location; on-farm label with information about the product. There are also QR codes and barcodes for retailers and consumers; VietGAP compliance tracking log for each shipment which compliance reports are stored in the cloud. The presentation was well received by the audience. A media article about Nga's presentation. [Click here](#)



Figure 14. Nguyen Thi Nga giving her presentation

See Appendix 5 [for a newspaper article on the Agribusiness forum in Hanoi February 2023](#) and Appendix 6 for the presentation.

9 Conclusions and recommendations

9.1 Conclusions

The technical feasibility and value of digital monitoring of VietGAP compliance and quality in Vietnam vegetable value chains has been successfully demonstrated. Three cooperatives in Son La are now empowered with new skills and technology to target higher value customers through improved vegetable quality and packaging.

The tools developed and adapted in this project can be adapted and upgraded to provide digital traceability and supply chain quality monitoring in fruit value chains focussed on modern retail in Vietnam, and export.

The data entry app needs to be improved to include all the data VietGAP requires, and the software developed by Hitachi requires further development to ensure is reliable and user friendly. The information available to consumer from the QR code needs to be simplified and focus on basic crop data and the farmer.

Consumers value an assurance that the vegetables they eat are safe, and VietGAP along with labelling and quality gives them that assurance, and they are willing to pay for it.

9.2 Recommendations

1. That the pilot cooperatives in Moc Chau be supported for another season to understand how to embed the traceability system and get the maximum benefit from the supply chain monitoring functionality
2. The traceability system be improved by adding functionality to the data entry app to include all the data VietGAP requires, and the software developed by Hitachi be further developed to ensure is reliable and user friendly. The information available to consumer from the QR code needs to be simplified and focus on basic crop data and the farmer.
3. Any future work should focus on greater collaboration with local Vietnamese developers to ensure that the software can be delivered and supported at a sustainable cost. There should also be a focus on simplifying the process of data entry.
4. The digital traceability and supply chain monitoring technology be expanded to include the fruit sector in Vietnam and also export.
5. Future investments in this area by ACIAR should focus on how the tools can help farmers and retailers deliver improved and consistent quality as well as the VietGAP compliance aspect.
6. Pesticide residue testing be included in the system either at farm or retail level, to add confidence that produce is safe.

10 References

10.1 References cited in report

Refer to footnotes in the document

10.2 List of publications produced by project

None to report

11 Appendixes

Appendix 1 Consumer Research QR Code Moc Chau Vegetables

Appendix 2 Trip report April 9 2022

Appendix 3 Hanoi Retail Assessment plans June 2023

Appendix 4 Hitachi Scope of Works

Appendix 5 Article on the Agribusiness forum in Hanoi February 2023 Utilizing digital tools in vegetable production management

Appendix 6 Digital agriculture event Hanoi presentation

Appendix 8 Itinerary Vietnam Itinerary September 2022

Appendix 9 Scoping study February 2023 Trip Report V2

Appendix 10 Updated AHR Hitachi ACIAR- VietGAP tracking System Design June 2023