In partnership with Canada

GAP ANALYSIS OF TRACEABILITY SYSTEM REPORT

April 2023, Ha Noi, Viet Nam

SAFEGRO

About the project

Funded by Global Affairs Canada, our project seeks to enhance the Vietnamese people (Ha Noi & Ho Chi Minh city) access to safe and competitive agri-food products, with an aim to improve the well-being of consumers as well as other agri-food actors. SAFEGRO project is implemented by Alinea International in partnership with the University of Guelph.

Food safety is a major public health concern. Many people do not trust food safety enforcement at informal markets where they buy most of their food. Trade for Vietnam's commodity exports also suffers due to a lack of compliance with international standards.

SAFEGRO project works with national and municipal governments to modernize food safety capacity among regulators, thousands of smallholder farmers, cooperatives, processors, retailers and consumers along specific meat and vegetables value chains in Ha Noi and Ho Chi Minh city. SAFEGRO supports Vietnam's Ministry of Agriculture and Rural Development, Ministry of Health and Ministry of Industry and Trade jointly.

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Abbreviations

AIDC	Automatic Identification and Data Capture
CTE	Critical Tracking Events
DT	Digital Transformation
EAN	European Article Number
EDI	Electronic Data Interchange
EPCIS	Electronic product code information service
FBO	Food Business Operator
F&V	Fruits and Vegetables
GS1	GS1. Global Standards Organization (not an acronym)
GTIN	Global trade item number
GLN	Global location number
GDSN	Global data synchronization network
IEC	International Electrotechnical Commission
ISO	International Standards organization
KDE	Key Data Elements
OCOP	One Commune One Product
MARD	Ministry of Agriculture and Rural Development
MOIT	Ministry of Industry and Trade
MOIC	Ministry of Information and Communication
MOH	Ministry of Health
MOST	Ministry of Science and Technology
NAFIQAD	National Agro-Forestry-Fisheries Quality Assurance Department
NBC	National Numbering and Barcodes Centre
RFID	Radio Frequency IDentification
SSCC	Serialized shipping container code
STAMEQ	Directorate for Standards, Metrology and Quality
STC	Short-term Consultant
TCVN	Vietnam National Technical Standard (voluntary)
TOPS	Technology, Operations and People
TS	Traceability Systems
UPC	Universal Product Code
VNTP	Vietnam National Traceability Portal
W3C	Worldwide Web Consortium
XML	Extensible Markup Language

1. Executive summary

Vietnam can be considered a transitional or emerging economy, situated between developed economies such as Canada and less developed neighbours such as Cambodia and Lao PDR. The historical reliance on the government for many societal roles and functions is deeply ingrained in Vietnamese culture. Vietnam has historically been a low-income and frugal society, emphasizing the freshness and price of food products purchased primarily at traditional wholesale and retail wet markets. The following section highlights the main findings and recommendations of this report.

Vietnam has adequate legal and normative documents in place for traceability and recall, but gaps exist for signature and high-risk products.

According to our research and the inputs from the Gender-Based Value Chain Analysis (GBVCA) and Policy research teams, Vietnam has adequate legal and normative documents regulating food traceability and recall. However, gaps were identified for enforceable regulations for signature and high-risk products. Signature products may include provincial specialties or products under the One Community, One Product (OCOP) program or those awarded geographic indicators by the government of Vietnam. High-risk products include food of animal origin and other agri-food categories considered high-risk for human health and safety.

The Ministry of Science and Technology (MOST) has state management for traceability (and recall), which are regulated through four Laws, five Directives, six Circulars and twenty voluntary national technical standards (TCVNs), see Appendix 2. As of Feb. 2023, MOST, through its STAMEQ/NBC department, is updating a 5th law (Product Quality) to specify traceability requirements.

Note: while NBC/GS1 Vietnam has published twenty national technical standards (TCVNs) with specific traceability guidelines for meat, poultry, fish, etc., these TCVNs are voluntary and not enforceable.

Implementing and enforcing laws, directives and circulars related to agri-food is a complex cross-institutional challenge that impacts consumer trust.

The overall agri-food governance mechanisms, such as monitoring and enforcement actions, as well as industry practices using national technical standards (TCVNs), have yet to mature or modernize to the point where they facilitate adequate supply chain transparency and consumer trust in safe and traceable food. According to recent research discussed later in this report, consumer trust in Vietnam's agri-food sector and the institutions that protect and monitor it is low. Establishing consumer trust in the governance and practices of Vietnam's agri-food system must become a top priority, presenting numerous challenges and opportunities for a transitional economy.

SAFEGRO should align efforts in support of Decision No.100/QD-TTg

The Vietnamese government issued Decision No.100/QD-TTg on January 19th, 2019, launching a national traceability initiative. The Decision establishes a framework for the digital transformation of traceability through 2025 and a vision for 2030, which includes a national traceability system (VNTP), cross-ministry, and cross-provincial collaboration. Because three ministries share responsibility for food products, Decision 100 mandates the creation of traceability portals within the Ministries of Agriculture and Rural Development (MARD), Industry and Trade (MOIT), and Health (MOH). All traceability portals/solutions in the public and private sectors must eventually be interoperable with VNTP, managed by the Ministry of Science and Technology (MOST). Decision 10 requires provinces to release detailed implementation plans and has the potential to propel Vietnam beyond the world's most developed nations' traceability capabilities.

Based on Decision 100, SAFEGRO could consider co-developing a comprehensive national *traceability implementation framework* with MOST (STAMEQ/GS1 Vietnam) to serve as a digital transformation and

industry standards-based tool for Vietnamese producers and exporters seeking to improve transparency and trust in safe and traceable agri-foods. By providing trust mechanisms to verify the source, authenticity, and credence[1] claims related to food products (e.g., VietGAP, organic), the framework can strengthen the 'brand Vietnam' domestically and in international markets as a safe and traceable food supplier.

SAFEGRO can assist Vietnam by urging regulatory bodies to publish simplified industry guidance for traceability and recall online.

It is recommended to have clear guidelines on traceability and recall on government websites for the food industry. Guidelines must bridge the gap between the regulations and expected industry practices. Appendix 1 shows an example of the Canadian Food Inspection Agency website with resources such as a Traceability Handbook for Industry, Traceability Fact Sheet and other resources such as traceability training for inspectors.

SAFEGRO can assist Vietnam in improving transparency and trust in traditional wet markets by recommending best practices for trader signage.

According to recent research (discussed later in this report), Vietnamese consumers have high anxiety about food safety and their families' long-term health and safety. However, they balance their perceived risks and benefits based on relationship bonds and blind trust that develops over time with farmers, who are perceived to be more transparent (than non-farmer actors such as traders) and honest about the food's origin and production methods. Compared to Hanoi, several traditional wet markets in Ho Chi Minh City appear well-organized, show good examples of trader signage, and display basic traceability information. As consumers purchase food primarily at traditional wet markets, it is strongly advised that best practices for signage and trader data (name, phone number, product source, email, website, etc.) required for traceability be documented and promoted. Examples and photos are discussed later in the report.

SAFEGRO can assist Vietnam through capacity building on the benefits of traceability on the supply and demand side.

Agriculture in Vietnam is highly decentralized and heavily reliant on small-scale household farmers (smallholders) with limited financial resources and technical expertise. Smallholders lack incentives to maintain their farm diaries manually or to adapt and use new technologies such as e-farm diaries. As a result, digital-based food traceability has seen minimal deployment beyond the cooperatives. Capacity building on the benefits of traceability should be organized for smallholders, collectors, and cooperatives. Consumer awareness and willingness to pay for traceability should be researched, measured, and improved on the demand side.

SAFEGRO can help to improve traceability by aligning and leveraging with the leading food retailers. Formal markets positively influence smallholder compliance with regulations and industry standards.

In recent years, Vietnam's formal retail channels have made remarkable progress, with prominent and informative in-store signage, improved packaging and labelling of fresh produce and meats, GS1-compliant barcodes for point-of-sale scanning and widespread usage of QR codes for traceability. While traceability practices and digital technologies appear adequate in formal retail, the national standard (TCVN 12827:2019) *Guideline for fresh fruit and vegetable traceability* is not widely known. It's important to note that large retailers in Western markets play a significant and influential role in driving smallholder compliance with food safety regulations and industry standards for efficiencies in their supply chains through their supplier contracts, including regular on-farm monitoring and frequent food safety testing. The research team met with the CEO of Mega Mart, a former Carrefour France executive, and the CEO of

[1] Credence is a term used to describe product attributes that are unobservable and unverifiable by the buyer before or after purchase, such as food quality, food safety and other claims such as VietGAP, Organic etc. See https://www.investopedia.com/terms/c/credence-good.asp

TOPS market, a former Wal Mart USA regional executive. Both executives understand the importance of GS1 standards to aid food safety, traceability and recall and welcomed the opportunity to work with SAFEGRO.

SAFEGRO can assist Vietnam in restructuring the VietGAP accreditation by recommending a single logo and national registry that business buyers and consumers can query.

The VietGAP accreditation is frequently portrayed as a hallmark of safe and traceable food. However, recent research, interviews, and prominent media reports suggest that the VietGAP accreditation is unreliable, unorganized, and vulnerable to market abuse. Furthermore, the research team was advised that there may be 140 or more VietGAP logo interpretations on the market and that certification bodies (CBs) may claim ownership of 'their version' of the logo. The lack of standardization severely limits the VietGAP logo's potential to serve as a proxy for consumer trust in product safety and traceability. Business buyers and consumers should have access to a central registry, independent of the trader, to verify that the VietGAP claim is authentic. Consideration should be given to applying a GS1 serialized identifier to VietGAP certificates (and other credence claims). The USDA Organic governance processes and website should be used as a best practice. See https://www.usda.gov/topics/organic

SAFEGRO should maintain an independent and impartial stance regarding private-sector technology solution providers active in food traceability.

There are many capable Vietnamese and international solution providers to choose from to advance GS1-based traceability and recall solutions in Vietnam. To prevent the perception of an unfair competitive advantage, it is strongly urged that SAFEGRO maintain an unbiased and independent posture toward the selection, application, and financial support of existing private-sector technical solutions for traceability and recall. Technology solution providers and their clients in the public and private sectors should invest in improving the functionality of current solutions based on market demand, affordability and sustainability. Solution providers should engage with GS1 Vietnam directly for guidance on how to integrate GS1 standards and TCVNs into their technological platforms.

SAFEGRO should align with GS1 Vietnam and aid in promoting existing TCVNs for traceability and recall and in developing new guidance documents that align with SAFEGRO value chains.

The following table summarizes the necessary interventions. All interventions require a detailed plan with objectives, resources, expected outcomes and a timeline with costs and expected benefits.

Stakeholder	Traceability Awareness	VNTP Awareness	Interoperability Awareness	Traceability Training	Traceability Plan	Mock Recall	Traceability Pilot	e-Diary Pilot	QR-ID on Certification
Smallholder	■	■		■	■	■	■	■	
Cooperatives	■	■	■	■	■	■	■	■	
Collectors	■	■		■	■	■	■		
Traders	■	■		■	■	■	■		
Retailer	■	■	■	■	■	■			
Caterers	■	■		■	■	■			
Kitchens	■	■		■	■	■			
Solution Providers	■	■	■	■		■	■		
Consumers	■	■							
Regulators	■	■	■	■		■	■	■	■
Certification Bodies	■	■							■
Laboratories	■	■							■

2. Introduction

This draft report provides a high-level overview of the traceability and recall gap analysis and potential interventions in Vietnam's Agri-food ecosystems modernization and digital transformation. The report is evidence-based, drawing on prior research, field visit notes, interview questionnaires and more than 650 photos/videos. Contextually, supply chain transparency, consumer trust, digital transformation, quality certifications, credence claims, and supply chain standards are incorporated. The report highlights Vietnam's key export markets that require robust traceability and the ability to recall unsafe foods.

The Hanoi and HCMC field missions comprised two short-term national consultants (STCs), cross-functional SAFEGRO team members, GS1 Vietnam and an international expert from Canada as team leader. High-level evidence is incorporated and referenced/cited from the gender-based value chain and policy team analyses. The research team attended more than fifty formal meetings, including several overnight visits to traditional wet markets and abattoirs, numerous ministries and sub-departments, farms, cooperatives, industrial and school kitchens and formal retailers. A list of the establishments visited (excluding numerous visits to ministries with the policy team) can be seen in Appendix 3.

The traceability research team had three formal meetings with the Director General of NAFIQAD, Mr. Nguyen Nhu Tiep, which included a summary presentation of key initial findings discussed on December 16th, 2022.

To better understand the current situation and potential interventions for safe and traceable foods, desk research examined empirical evidence from Vietnam-based studies on willingness to pay for traceability and quality certificates. The report also draws on evidence from a two-year study on digital food traceability in Vietnam sponsored by the World Bank (Vietnam) and conducted by Ernst & Young Vietnam. The World Bank study, whose release is planned for late 2023, underwent significant technical editing and refinement in 2021/2022 by the international expert overseeing the SAFEGRO traceability initiative.

This project report briefly addresses the importance of Decision No. 100/QD-TTg (2019), which establishes the goal for digital transformation and traceability and specifies that each of the three ministries in charge of food must establish their internal portal for traceability and recall. Due to scheduling restrictions (before the end of the calendar year) and the bureaucratic processes necessary to schedule formal meetings, the traceability team did not have the opportunity to meet with the three ministries in December 2022 or during the pre-TET period in January 2023. However, it's important to note that the Ministry for Science and Technology (MOST) is responsible for state-wide traceability. The National Barcode Centre (NBC/GS1 Vietnam) within MOST is already an essential member of the SAFEGRO traceability team and is working directly with the Ministries of Industry and Trade (MOIT) and of Health (MOH) on their respective traceability portals. As of January 2023, NBC/GS1 did not have a working relationship with the Ministry of Agriculture and Rural Development (MARD) or its sub-departments on their traceability portal. This should be addressed as a high priority.

In summary, the team is confident that they have gathered and analyzed sufficient evidence for the mission to draft this report with preliminary findings and early indications of potential interventions. However, additional work must be completed in consultative workshops with stakeholders to refine the gap analysis and our understanding of the issues, opportunities, and feasibility of interventions.

2.1 Gap Analysis: High level findings and observations

Despite the progress toward modernizing Vietnam's Fruit & Vegetable (F&V) and meat sectors, stakeholder interviews, site visits, and desk research revealed gaps in agri-food governance, enforcement, industry capability and practices, resource availability (expertise and finances) and the ability to implement industry standards-based solutions. The high-level findings are summarized as follows:

- The Ministry of Science and Technology (MOST) has state management for traceability and published twenty national technical standards (TCVNs) related to traceability and recall. TCVN 12850 *General Requirements for Traceability Systems* is the foundation for implementing a standards-based traceability system, which provides the general requirements for a national standardized traceability system. Other related TCVNs, such as TCVN 12827 for fruit and vegetables, TCVN 13166 for meat and poultry, and TCVN 13167 on compliance, were published to detail specific implementation requirements for traceability systems in supply chains. TCVN 13274 and TCVN 13275 are the guidelines for tracing product codes and data carriers involved in the traceability process. *See Appendix 2*.
- Despite the issuance of numerous laws, decrees, circulars and national standards, industry knowledge and adoption of formal, standardized traceability and recall processes are weak outside the GS1 member base. Furthermore, as TCVNs are voluntary, they are not enforceable.
- NBC/GS1 Vietnam has been tasked with implementing the Vietnam National Traceability Portal (VNTP). The portal was designed using GS1 global standards for product identification and system interoperability embedded. GS1 Vietnam received the VNTP portal for user testing and scalability purposes in November 2022, with a potential go-live date in late 2023. SAFEGRO must align its efforts for traceability with the national strategy (Decision 100 and VNTP).
- Traceability is almost non-existent in informal markets. Although markets require the traders to maintain traceability records manually (and some do), the management board of a wholesale wet market in HCMC, for example, noted that more than 95% of all fruits and vegetables sold in the market are untraceable. They indicated that lower-quality produce is often falsely sold as being from areas with known high quality.
- There is an observed lack of knowledge, awareness, and interest on the *supply side* of the value chain of the importance of traceability and labelling to support food safety, especially with smallholders and traditional market traders. Perceive additional costs, lack of incentive and no *demand-side* need for traceability and quality labelling were noted.
- Recent research and our field conversations suggested a lack of trained government resources for monitoring, inspection and enforcement actions for food safety, traceability & recall compliance.
- When food safety testing is done at wet markets, the time from sample to results can be +/- 24 hours. When the results are known, the produce and meat are sold, distributed, and possibly consumed. Recalling the unsafe product would be considered impossible and unnecessary in these cases.
- We observed a good practice in **Pham Van Hai** informal retail wet market in Ho Chi Minh City, where the meat and vegetable traders had large and prominent signage above their stalls. The signage is colour-coded by commodity and includes static data (needed for traceability) about the trader, including contact details and a QR code for e-commerce purposes. It is highly recommended to expand and promote such signage systems as a best practice.
- We observed isolated poor practices in formal retail outlets where two QR codes and two linear barcodes were placed on chicken and pork products. This practice is unnecessary, should never occur, and is confusing for consumers as the two QR codes on these products presented different information when queried using a mobile phone.
- We observed a labelling practice at a butcher counter in a foreign-owned retailer where staff were packaging meat and applying label stickers from their supplier (brand information). This practice creates potential risks for traceability and food safety as meat from other sources appears to be processed simultaneously and nearby.
- Parents and teachers are commonly used in school kitchens to receive and inspect daily food deliveries. Delegations are also formed for farm inspection visits. These volunteers lack specific training and knowledge of food safety risks and testing protocols and how to investigate and

comprehend traceability and recall. We noted that one school listed the supplier "CP" as a direct pork supplier. However, our follow-up interviews with the two cooperatives that supplied meat and vegetables to the school revealed that CP is not a direct supplier but is involved in farming practices with smallholders who raise the pigs.

- Industrial caterers are critical in food safety management and traceability because they source, prepare, cook, and deliver meals for millions of students, factory workers and government staff. Food safety risk management, food safety handling, and traceability best practices are where caterers differ in their knowledge, awareness, and competencies.
- According to recent research, media reports, and interviews with various stakeholders, trust in government and industry stakeholders to ensure safe and traceable food is low. Recent foodborne disease outbreaks in 2022 (e.g., Nha Trang children's school) and food fraud incidents (e.g., fake VietGAP products) are amplified in the mass media and social media, negatively impacting consumer risk perception.
- Due to the growing seasonality for fresh produce in northern Vietnam, an estimated forty percent of the Hanoi fruits and vegetables at the Minh Khai wholesale wet market were sourced from China. The management board at Minh Khai advised that goods entering Vietnam should be inspected at the border by competent authorities. This seasonal practice poses an additional risk in traceability and food safety (pending confirmation that these imported products are inspected/tested and deemed safe to distribute in Vietnam).
- Numerous competent technology solution providers offer competitive traceability solutions and services. Some have been adopted by the government, such as TE-FOOD in HCMC for pork traceability and hncheck.vn in Hanoi. However, while most, if not all, solution providers are aware of GS1 standards, supply chain technology solutions generally use proprietary technologies, limiting their ability to interoperate with other trading partners and VNTP. Interoperability will be a near-future concern for MOST/STAMEQ, as public and private traceability technology solutions must communicate with the VNTP.
- The Ministry of Information and Communications (MOIC) has proposed blockchain technology, and many solution providers have investigated its application for food traceability. Applying blockchain necessitates careful consideration of the risks, benefits, and barriers, as well as careful consideration of enabling and impeding policies.
- In Vietnam, empirical research on willingness to pay for quality certification and traceability is limited. However, scant research suggests consumers are willing to pay for quality, safety labels, and traceability.
- We observed a global best practice at the Ho Chi Minh City-based retailer Bách hóa Xanh. After detecting an unsafe product, they can block all point-of-sale devices in over 1,700 retail stores. This world-class capability is similar to the Korean government's cross-ministerial solution with GS1 Korea. All points of sale in Korea are blocked within 30 minutes of the government notifying retailers that a product is unsafe to sell. The GS1 barcode and its embedded global trade item number on food products are blocked in this case. They cannot be sold, protecting consumers from potential harm.

The following section explores the digital transformation (DT) of Vietnam's agri-food ecosystems as an enabler of enhanced transparency and trust.

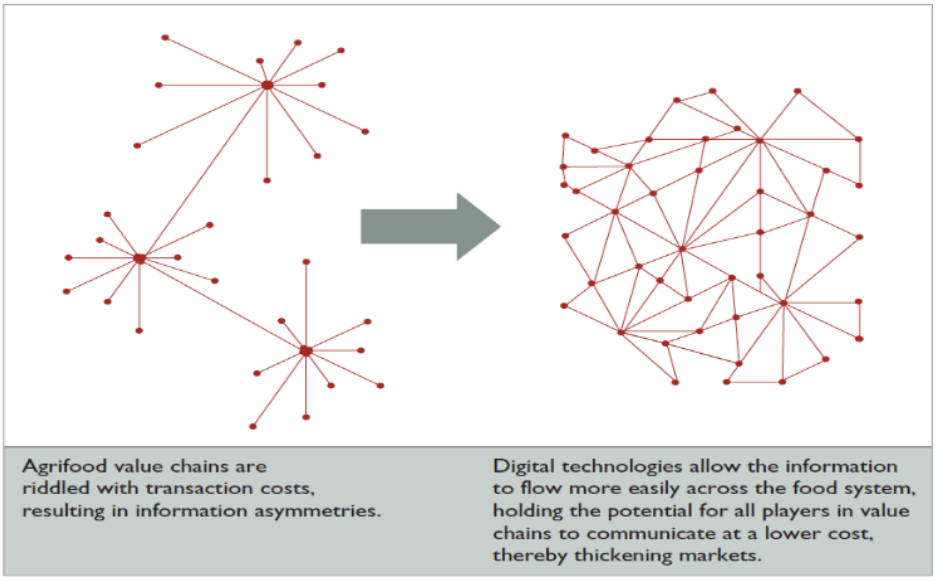
3. Digital Transformation

The agri-food ecosystem in Vietnam is primarily manual, with labour-intensive data collection and sharing. As a result, all stakeholders incur high transaction costs, and information asymmetry[2] is the norm. From a government perspective, digital transformation (DT) of these inefficient and administratively burdensome processes is critical. A transition to e-services (online accessibility) in the public sector will reduce the burden on food business operators to interact with and report to the government. The DT of Vietnam's agri-food ecosystem can help to drive significant efficiencies from primary producers to consumers by reducing transactional costs, eliminating information asymmetries, and acting as an agri-food policy design, delivery, monitoring, and reporting mechanism.

From a food industry perspective, an effective DT strategy should enhance transparency and trust in food systems production, including mechanisms that help verify and validate product origins, traceability, and automation of product recalls or market withdrawal notifications. Importantly, DT can ensure that quality and safety certifications and other process or product claims are verified by connecting the certificate issuing agencies (and potentially food testing laboratories) to digital ecosystems that end consumers and domestic and foreign buyers can query.

Figure 1 is an excerpt from the World Bank's What's Cooking series on the Digital Transformation of the Agri-food System (2021, p 3)[3] and addresses the broader context of the benefits of DT. This includes the reduction of information asymmetries and associated transaction costs and the benefits derived from an enhanced flow of information, primary producers' access to upstream and downstream markets for price discovery, new customers, and new markets.

Figure 1 Digital technologies allow information to flow more easily across the food system. Source: World Bank



In Figure 2, World Bank (2021, p 185)[4] provides a helpful policy framework which separates tier 1 and tier 2 enablers and highlights key policies that enable the adoption of DT. For example, strengthening farmers'

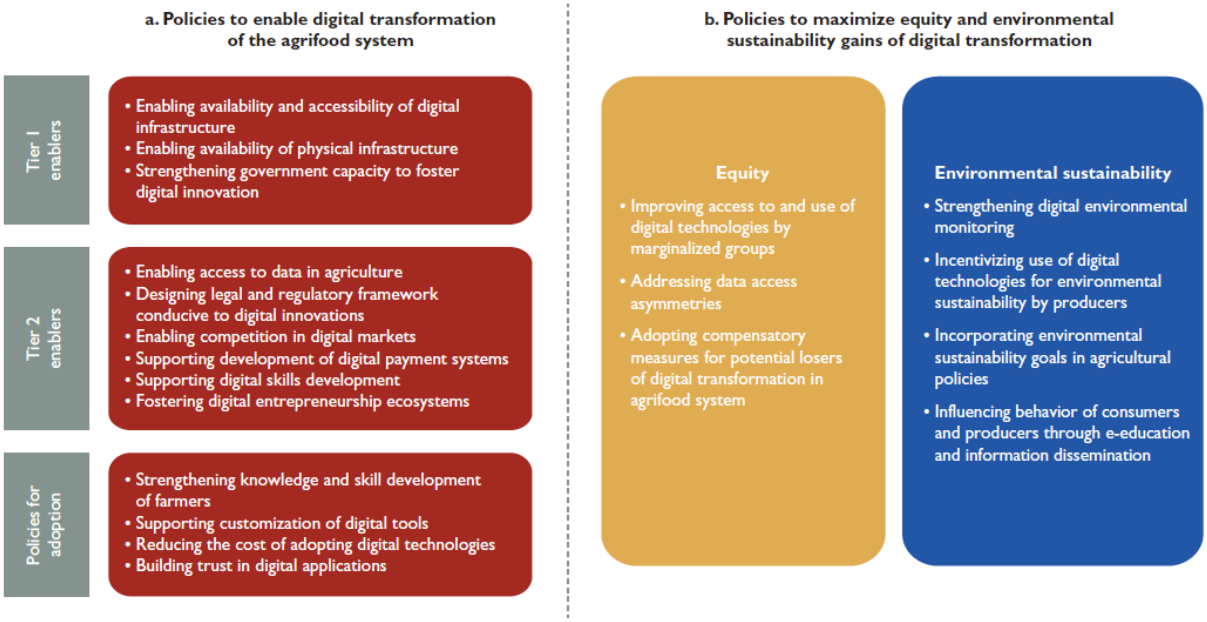
[2] Information asymmetry in the food chain refers to the unequal distribution of knowledge and information between producers, sellers, and consumers, which can lead to hidden risks or disadvantages for one party in terms of food safety, quality, claims (VietGAP) or nutritional content.

[3] World Bank's What's Cooking series on Digital Transformation of the Agrifood System (2021)

[4] World Bank (2021) What's Cooking: Digital Transformation of the Agrifood System

knowledge and skills development (people), ensuring support to customize digital technology tools, reducing adoption's economic and technical burden and, importantly, building trust in digital systems.

Figure 2 Policy Framework for Fostering Efficient, Equitable, and Environmentally Sustainable Digital Transformation in Agrifood Systems. Source: World Bank (2021)



Source: World Bank.

As a cautionary note, DT is often mistakenly classified as adopting and diffusing disruptive ***technology***. However, a technology-led approach may fail if the overall vision and strategy do not include capacity building and preparation of both ***people*** and ***organizations*** to evolve to digitally centric business models under stringent change management control. To aid organizations in developing their DT vision and strategies, research scholars[5] propose a framework called TOP or *Technology*, *Organizations* and *People*, see Figure 3. Successful DT lies at the intersection of all three. The technology pillar is generally well understood, and public and private sector organizations must demonstrate top-down leadership, make resources available, and develop a data-driven or digital culture. Capacity building with *staff* (the 'people') is essential as they are the cornerstone of a successful DT.

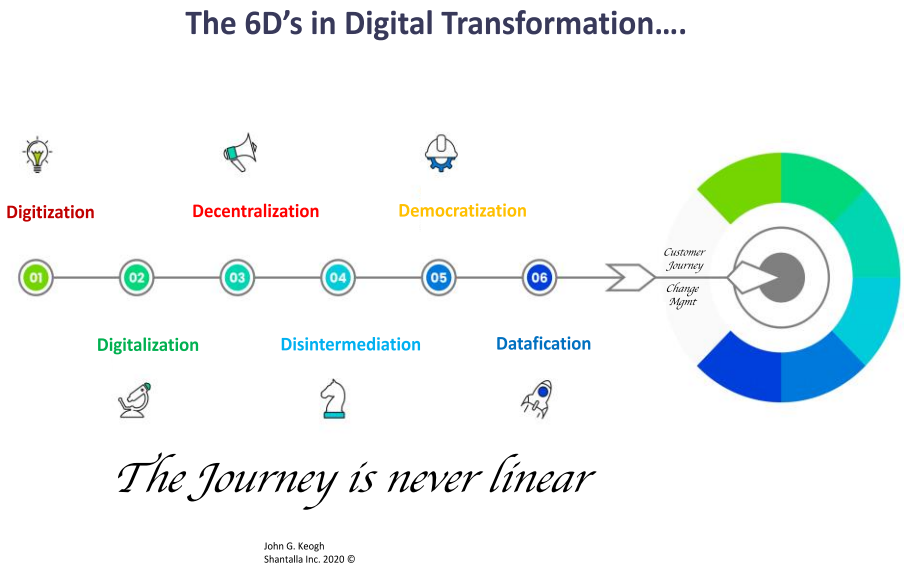
Figure 3 TOP Framework. Fosso-Wamba and Queiroz (2022)

[5] Samuel Fosso-Wamba and Maciel Queiroz (2022). Managing the Digital Transformation. CRC Press

The important first step in digital transformation is migrating from people-centric, manual and/or unorganized data collection, storage, and retrieval to more automated digital data capture, storage, and retrieval capabilities. This first step in DT is called ***digitization***. From a food supply ecosystem context, this is the most critical and often called 'fixing the data.' Without clean and structured data, the subsequent step of ***digitalization*** or business process and role automation may fail. As a result, trying to implement technology solutions such as blockchain to automate business processes without first focusing on cleaning, structuring, and organizing the data (as part of digitization) could result in a catastrophic failure. Food business operators and technology providers should use common global data standards from GS1 as a foundation layer to structure the data, enable interoperability and facilitate DT. Furthermore, case study research has indicated that approximately eighty percent of the project effort in digitalization (using blockchain) is in fixing the data[6].

Figure 4 depicts a 6D model in which *digitization* logically precedes *digitalization*. In this Framework, four other Ds can be considered, including *disintermediation* (eliminating the market intermediaries) and *decentralization* of technology, which means distributing tasks and control across a network, increasing security and autonomy and reducing the reliance on a central authority. Smallholder farmers who are digitally transformed become less reliant on selling to intermediaries such as cooperatives and can explore new markets such as local and regional food service, formal and informal markets, etc. Similarly, cooperatives that digitally transform become less reliant on organized and traditional retailers and can market to other buyers. *Datafication* is the transformation of data into a format that can be processed and leveraged through technologies like data analytics and machine learning to extract actionable insights for decision-making. *Democratization* of technology solutions refers to the process of making advanced and often complex technologies more accessible, affordable, and usable for a broader range of people, businesses, or organizations. Facebook is a good example of democratization with exceptional user-friendliness and accessibility. This Framework suggests that a clear focus on the customer journey and the transition to digital business models must be managed through effective change management and capacity building for organizations and employees (people).

Figure 4 The 6Ds of Digital Transformation. Source. John G. Keogh (2021)



6 Fosso-Wamba et al (2019) Bitcoin, Blockchain and Fintech: a systematic review and case studies in the supply chain

3.1 Vietnam's socio-economic development requires Digital Transformation

In the socio-economic development strategy for 2021-2030 and vision for 2045[7], digital transformation in Vietnam is an essential national strategy. Applying science, technology, and digital transformation to traceability is a necessary and urgent task, especially for global economic integration. Because Vietnamese food and vegetables (F&V) are consumed globally, the demands from consumers and regulatory agencies overseas naturally increase. Subsequently, the quality, safety, authenticity, and transparency of Vietnamese-origin F&V are essential in overseas markets and consumer buying decisions. Applying advanced solutions and technologies in product processing and management along the entire supply chain is the key to improving competitiveness and helping businesses survive and thrive in the current volatile global market.

The necessary technical infrastructure must be in place before DT can be implemented in Vietnam. Figure 5 depicts the availability of cell phone and Internet coverage, the affordability of mobile phones and the enabling environment, which includes access to electricity and fundamental skills. Vietnam's agricultural index is 69.7 percent overall. In comparison, the United States has an agricultural index score of 86.1 percent, Russia has 74.5 percent, Cambodia has 71.6 percent, Saudi Arabia has 68.5 percent, and Lao PDR has 50.2 percent.

Figure 5 Agriculture Digitalization Index. Source: World Bank (2021, p 203)

		Availability				Affordability					Enabling environment				
Country	Agriculture Digitalization Index	2G coverage (%)	3G coverage (%)	4G coverage (%)	Digital Agriculture Availability Subindex	Mobile tariffs	Handset price	Mobile-specific tax	Inequality	Digital Affordability Subindex	Market Access Index	Access To electricity	Basic skills	Online Services Index	Nondigital Enabling Environment Subindex
United Arab Emirates	81.5	99.5	80.0	58.1	**75.1**	79.6	83.7	91.2	63.4	**79.9**	99.2	100.0	68.8	90.0	**89.5**
United Kingdom	91.2	99.9	97.2	93.5	**96.3**	85.2	93.6	75.0	70.0	**82.7**	99.8	100.0	83.5	95.9	**94.8**
United States	86.1	92.8	87.6	84.9	**87.6**	80.1	100.0	69.3	46.0	**77.1**	90.5	100.0	89.5	94.7	**93.7**
Uruguay	74.5	99.6	97.1	14.0	**64.4**	79.5	72.6	71.6	57.5	**71.5**	92.2	100.0	73.8	84.1	**87.5**
Uzbekistan	52.1	99.3	18.3	0.2	**27.3**	62.4	13.0	49.3	62.3	**44.9**	99.2	100.0	59.3	78.2	**84.2**
Vanuatu	30.5	33.4	6.2	1.6	**9.8**	28.8	36.0	67.1	63.3	**45.5**	0	61.9	48.8	33.5	**36.0**
Vietnam	69.7	93.7	85.3	45.4	**71.0**	56.2	33.1	91.3	67.3	**58.5**	95.7	100.0	57.3	65.3	**79.6**
Yemen, Rep.	33.3	90.3	1.2	0	**18.5**	0.3	14.2	69.0	58.0	**29.8**	82.2	62.0	29.9	32.4	**51.6**
Zambia	30.3	62.4	9.5	0.5	**16.5**	43.7	41.2	8.9	0	**27.3**	70.2	39.8	52.3	25.9	**47.0**
Zimbabwe	29.4	56.1	4.6	0.4	**13.2**	2.4	9.2	30.0	45.0	**18.5**	84.5	41.0	47.6	52.4	**56.4**

Source: World Bank.
Note: In order to ensure consistent units of measurement, all indicators have been normalized to have a value within a range of 0 to 100, with a higher score representing stronger performance. ■ = score above 75; ■ = score between 50 and 74.9; ■ = score between 25 and 49.9; ■ = score between 0 and 24.9.

With the application of advanced technologies, information asymmetry between all actors in the supply chain can be reduced. Hence, information about products, how they were produced, by whom and under what conditions is more visible, transparent and interoperable. Furthermore, actionable data is necessary for management decision-making and can help mitigate the risk of counterfeit goods and commercial fraud within domestic and global supply chains. Traceability technologies can help to detect non-conformity points in value chains and proactively improve efficiencies. Accordingly, one of the critical requirements of the Industry 4.0 economy[8] is to enhance the interoperability of data and information between parties in the supply chain. The priority is the digitization of (manual) traceability data, resulting in a significant reduction in transaction costs.

[7] Decision 749 https://thuvienphapluat.vn/van-ban/Cong-nghe-thong-tin/Quyet-dinh-749-QD-TTg-2020-phe-duyet-Chuong-trinh-Chuyen-doi-so-quoc-gia-444136.aspx. Resolution 13 https://thuvienphapluat.vn/van-ban/Bo-may-hanh-chinh/Nghi-quyet-Dai-hoi-dai-bieu-toan-quoc-lan-thu-XIII-512918.aspx

[8] https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-are-industry-4-0-the-fourth-industrial-revolution-and-4ir

It is conceivable to build a digital geographic map of Vietnamese agricultural product origins based on traceability data to support products and their e-commerce promotion domestically and abroad. This application can be developed into a solution for overall agricultural production management, updating and monitoring all information, ideally in real time. It would further serve to enhance transparency and trust in Vietnamese agri-foods.

Recognizing the significance of DT and the value of GS1 standards, GS1 Vietnam is developing a fully digital, GS1-based traceability ecosystem. Increased digitalization, speed, and data accuracy increase trust and transparency. All solution providers in this ecosystem are provided with a common language for interoperability and guidance on implementation. Digital traceability enables the digital transformation of the supply chain, ultimately benefiting consumers. It responds to an increasing consumer' desire and expectation to use digital technologies, particularly smartphones, to search for products and source information. The VNTP is at the heart of this ecosystem. This national system can cover all supply chains because it is multi-ministry, multi-province, multi-sector, and internationally interoperable. Digital traceability, GS1 standards and VNTP will be critical components of the Vietnam digital transformation strategy.

4 Desktop research on Transparency and Consumer Trust in Food Safety and Traceability signals in Vietnam

This section explores the literature on transparency, consumer trust, willingness to pay for quality signals, and traceability. It highlights findings from relevant empirical research completed in the Vietnamese market that overlap with the traceability gap analysis. Consideration is given to the importance of GS1 standards as an intervention to improve transparency and trust.

4.1 Transparency and trust in food safety in Vietnam

Researchers examined the indicators and cues for food safety among Hanoi shoppers (n=700) in 2020. They discovered consumers distrust food safety and quality certifications such as VietGAP, GlobalGAP, and others[9]. Distrust, in this context, generally refers to suspicion, whereas the term mistrust is more often used when trust has been violated through experience. This is problematic as these product certification logos are intended to signal higher-quality and safe food. The VietGAP certification logo is also non-standardized, reducing its signalling strength[10] and ability to act as a proxy for consumer trust. For example, the USDA Organic logo is standardized globally. Its logo sends a strong signal of trust to consumers, who associate the logo with government enforcement and controls. Further, the USDA Organic website lists all certified food firms and products by country and product. The website lists fraudulent USDA Organic claims by country and product. Trust in VietGAP as a signal of high-quality and safe food suffered in September 2022 in a high-profile food fraud incident where vegetables of unknown origin were bought from wholesale markets and falsely packaged as VietGAP and then sold to the formal retail trade[11].

In a mixed-method study (survey n=498 and three focus groups of eight participants) conducted in Hanoi[12] in 2019, the authors discovered that consumers have high anxiety about food safety. Consumer concerns about pesticide residue levels and the presence of food preservatives and hormones in livestock were highlighted as the foremost concerns. Notably, 94.4 percent of urban consumers (n=268) were concerned about pesticide residue versus 90.4 percent of rural consumers (n=230). Consumer concerns were influenced by mass media and social media information, which amplified incidents and risks. According to the researchers (p. 243), "*we found that food safety was a primary concern for a vast majority of food shoppers in Hanoi. Consumers worried about various food hazards, particularly chemical ones that were perceived to be invisible, with long-term effects and serious health consequences*".

In another recent study conducted in 2022, researchers found that trust in local government, farmers and traders was relatively low in a survey[13] on consumer purchase intention and consumption (n=463) of conventional vegetables in Hanoi wet markets. As a result, purchasing conventional vegetables was perceived as high risk. Despite the perceived increased risk, consumers form relationship bonds[14] with producers/farmers who are considered knowledgeable and more transparent about methods of production and food origin (as opposed to non-farmers who act as collectors/traders). As a result of these

[9] Le et al (2020) Consumers' trust in food safety indicators and cues: The case of Vietnam.

[10] Signaling strength in a marketing context refers to the effectiveness and credibility of a marketing message or signal in conveying valuable information to consumers about a product or brand's qualities, benefits, or attributes, influencing consumer perceptions and behavior.

[11] https://tuoitrenews.vn/news/business/20220921/fake-vietgap-vegetables-found-in-clean-food-store-chain-in-ho-chi-minh-city/69178.html

[12] Ha et al (2019) Consumer concern about food safety in Hanoi, Vietnam. Food Control, Volume 98

[13] Ha et al (2022). A risk-benefit approach to the purchase and consumption of conventional vegetables in wet markets. Appetite 176

[14] Relationship bonds are deep connections between individuals or groups characterized by emotional attachment, trust, and mutual understanding. These bonds play a fundamental role in forming strong, supportive relationships and can be found in various contexts, including friendships, family relationships, and professional connections.

bonds, a form of *blind trust*[15] develops over time between the consumer and the producer/farmer that strengthens the consumer trade-off in food safety risks/benefits. Trust was linked in this study to perceived hedonic benefits[16], such as the pleasure of eating traditional and culturally relevant vegetables purchased in a culturally acceptable environment (wet markets). The reference to blind trust is similar to a study by Dutch researcher Arthur PJ Mol (2014)[17] in his review of the governance of food quality in Chinese food markets. Mol contended that Chinese consumers distrusted traditional food quality and the institutions tasked to protect it (local government, laboratories, and food quality certification bodies). As a result, Chinese consumers formed bonds with producers/farmers. Transparency and trust were built over time in their face-to-face interactions.

4.2 Improving Consumer Trust: The importance of product traceability and the need for validation of certification and product claims

It is recommended that Vietnam prioritize consumer trust in the food ecosystem, including trust in the public and private institutions that govern and monitor it. Recurring high-profile foodborne disease outbreaks, such as the one in Nha Trang[18] that sickened 662 children and killed a 6-year-old serve as a reminder that there is no room for complacency. Product traceability and the ability to recall unsafe foods from the market are fundamental to food safety management.

Typically, consumers cannot verify the credibility and authenticity of food attributes (including food quality and safety) before or after purchase due to a lack of expertise, time, and money. Consumer validation of quality and safety signals, such as a VietGAP certification logo, is currently not possible as there are no formal mechanisms in Vietnam to facilitate the process (see earlier discussion on how the USDA achieves this for USDA Organic). Furthermore, the technical nature of certification schemes is beyond the average consumer's comprehension. As a result, consumers must rely on third parties to fulfil their role as intermediaries acting as moral agents[19] for food safety and claims management (e.g., VietGAP). These moral agents in the agri-food industry are the third parties, such as the certification bodies, inspectors/auditors, and food testing laboratories. Moral agents may be imperfectly aligned[20] with their food business operator clients. For example, while the food business operator (who pays the third party) may want them to do an efficient and effective job while also ensuring compliance and value for money, they may also pressure the third party (who may want to act ethically and lawfully) to do an incomplete job or provide false certification or test results.

4.3 The importance of industry-driven data standards: the case for GS1

GS1 standards have been powering global businesses for over 50 years. They are used by more than two million member companies across 155 countries worldwide. GS1's internationally recognized standards are technology-neutral and create a common foundation and language for businesses to capture, record and share product and supply chain information. The GS1 system of standards includes the GS1 traceability standard. This framework can be used by solution providers to design an interoperable system and enable traceability systems with disparate technologies to talk to each other. The standards are created through

[15] Blind trust in the food chain is when consumers rely on the safety and authenticity of products without verifying their source, quality, or safety, often assuming regulatory oversight and producer integrity. This can lead to potential risks and frauds in the food supply chain.

[16] Hedonic benefits in the context of buying food at traditional markets refer to the emotional and sensory pleasures that consumers derive from the shopping experience and the products themselves

[17] Arthur P.J. Mol (2014) Governing China's food quality through transparency: A review

[18] Nha Trang school kids' food poisoning caused by fried chicken wings

[19] In the context of food safety, moral agents are individuals, organizations, or entities that bear ethical responsibility for ensuring the safety of the food supply chain and protecting consumers from harm. These moral agents play a crucial role in making ethical decisions and taking actions that prioritize the well-being of consumers and the integrity of the food system.

[20] Moral agents may be imperfectly aligned due to financial or other motivations. Subsequently, there is a potential for conflicts of interest that can compromise their ability to act solely in the best interests of their clients or fulfill their broader ethical responsibilities (e.g., ensuring consumer safety).

industry consensus and provide a consistent data and information sharing format among all industry stakeholders, consumers, and governments.

Many organizations in Vietnam are familiar with and conform to product quality standards, such as TCVN ISO 9001 and TCVN ISO 22000. These standards have a clause on traceability requirements. Even though firms may meet these requirements, internal traceability is often limited. It is highly recommended that agri-food businesses implement digital technology systems to track and trace the input, internal process, and output from these operations. When an unsafe food recall or withdrawal is required, they need to act quickly and effectively. However, their traceability system may not be able to advise swiftly on their suppliers and customers. Therefore, a digital traceability system that follows a common industry standard is highly recommended to rapidly access this necessary traceability information.

Importantly, the risk of false signals, such as fake or expired certifications and fake laboratory test results for food quality, food safety, or organic processes, can never be fully eliminated. However, some market signals can be verified using a combination of DT and GS1 standards. For example, a serialized QR code printed on certificates and laboratory test results as part of a broader digital transformation vision and strategy that could incorporate GS1 data standards. When scanned, the serialized QR code electronically sends the query to the *issuing agency*[21] for a validity check. For example, a trading partner or a competent authority could use a mobile phone to scan a QR code and receive a green check mark indicating certificate validity or a red X indicating a fake or expired certificate. More modern solutions are available to address this problem. They could include verifiable credentials and cryptographically secured versions of paper credentials. See W3C revised industry standard on verifiable credentials[22].

Because of its immutability and data provenance, a blockchain-enabled solution can improve the integrity of various certifications issued in the food industry, including process quality and food safety documents. However, blockchain is frequently misrepresented as a guarantee of food origin and traceability, which can be a significant vulnerability depending on the value chain structure. Blockchain can only guarantee data provenance or when the data enters the system; this should not be confused with food provenance (origin), which can only be guaranteed through analytical laboratory testing of the product's ascertainable and verifiable characteristics.

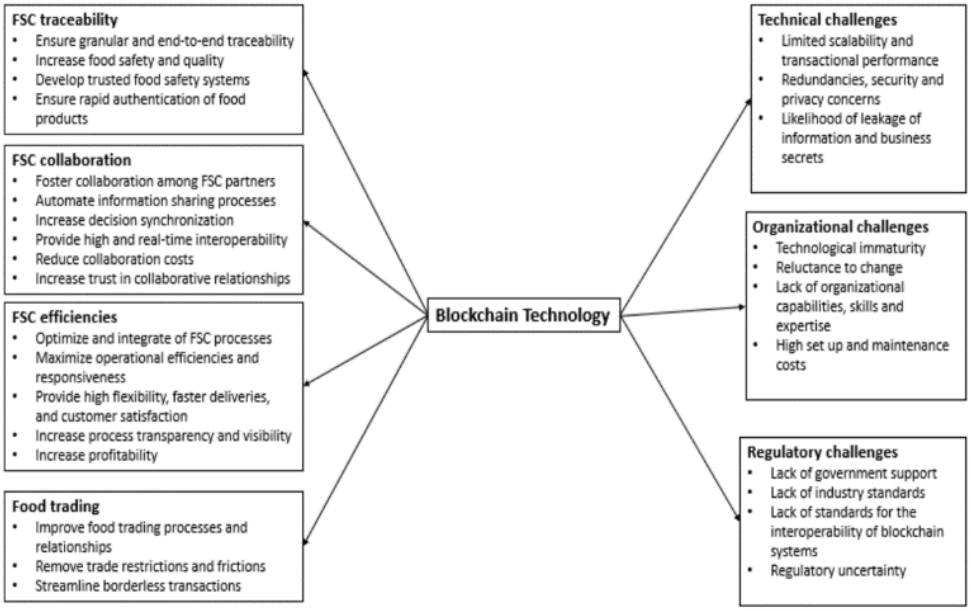
Figure 6 from Rejeb et al. (2020)[23] summarizes the potential and challenges of blockchain in the food supply chain. The researchers note (p, 1) that *"blockchain can enhance the integrity of credence claims such as sustainably sourced, organic or faith-based claims such as kosher or halal by integrating the authoritative source of the claim (e.g., the certification body or certification owner) into the blockchain to verify the claim integrity and reassure business customers and end consumers."*

[21] In the context of food certification bodies, the issuing agency is the organization responsible for granting and overseeing certifications that verify the quality, safety, and compliance of food products with established standards and regulations

[22] W3C. Verifiable Credentials Data Model v1.1

[23] Rejeb et al. (2020). Blockchain Technology in the Food Industry: A Review of Potentials, Challenges and Future Research Directions

Figure 6 The potentials and limitations of Blockchain in the food supply chain (FSC). Source: Rejeb et al. (2020, p 9)



Using GS1 standards, static data[24] about food business operators, their verified geographic location, legal business name, address, email, contact person, phone number and static data about their products will be "GS1 Verified". As of January 2023, GS1 Vietnam has approximately one million products verified and approx. Fifty percent are in the food industry.

GS1 standards also enable interoperability through the joint GS1/ISO data sharing standard, EPCIS or Electronic Product Code Information Services, which allows disparate technologies and applications to create and share supply chain visibility event data within and across enterprises. This can include business-to-business and between food business operators, scheme owners, third-party certification bodies (CBs), and food testing laboratories. The Vietnam National Traceability Portal (VNTP) was architected using the EPCIS standard.

When all food business operators apply common industry standards, a consumer scanning a GS1 QR code on a food product could get a display of the verified geographic origin of the company and product and other traceability-related data, including methods of production and harvest, related certifications verified by the issuer (the CB, or laboratory) and other data for brand marketing purposes. Note: while most of this scenario can be done today, the 'new' components included GS1 standards to facilitate brand/producer identity and geographic location, plus serialization of certificates and interoperability to scheme owners and CBs as well as analytical laboratories. Achieving this vision in Vietnam is essential to increasing consumer trust in the integrity of agri-food claims.

4.4 Vietnamese consumers' Willingness to Pay for Traceability and Labelling

Research[25] of Vietnamese consumers' preferences (n=300) for food labelling attributes of water spinach in 2022 reveals potential benefits for improved food traceability, as consumers are willing to pay a price premium for products with a traceability-related QR code. Furthermore, in this study, certified organic products with EU and USDA Organic branding received the highest consumer valuations. In contrast, VietGAP received the lowest valuations, possibly indicating the lack of trust among Vietnamese consumers in light of recurring incidents of false labelling[26]. The study proposes (p.11) "*the Vietnamese government*

[24] Static data are data about the food business operator (name, address, phone number etc.) and the product that typically does not change

[25] Tran et al. (2022) Willingness to Pay for Food Labelling Schemes in Vietnam: A Choice Experiment on Water Spinach. Foods, 2022, 11

[26] Ministry to scrutinise VietGap certifications after fake labels found on vegetables. September 24th 2022.

could consider adopting a robust regulatory system to guarantee uniformity and transparency of certification practices as an opportunity. A unified and credible logo of VietGAP could be issued to help consumers make more informed purchase decisions considering food safety".

Prior research[27] on consumer preferences (n=150) for traceable food and safety attributes for water spinach in Vietnam from 2019 highlighted (p.47) that the *"impact of food safety related attributes were identified in the order of decreasing magnitude: freshness, label, traceability, certification, and price."* The researchers note further that traceability is an indispensable instrument to build trust through labelling, and consumers are willing to pay a premium.

Research[28] on consumer intentions (n=230) to purchase traceable pork during the African Swine Fever (ASF) outbreak was carried out with university students in Ho Chi Minh City in 2020. The study used the TE-FOOD mobile application interface (see Figure 7). It analyzed the data using partial least squares - structured equation modelling (PLS-SEM) to predict consumer intention. Hypotheses related to consumer trust in government (7) and consumer trust in farmers (8) having a positive effect on risk perception were not supported. However, hypotheses on trust in the product, manufacturers, retailers, and the media positively affecting risk perception were supported. This research suggests that in a food safety crisis, trust swings away from the farmer and government to more trusted sources, namely the media, manufacturers, and retailers. Furthermore, trust in the product relates to product traceability (in this study, it refers to the TE-FOOD QR code on the pork product), which acted as a risk mitigation factor in a crisis and positively influenced the purchase intention. The researchers contend that when there is a perceived high risk of food safety concerns and animal diseases, consumers will favour products with traceability options as it reduces the information asymmetry between the producer and consumer.

Figure 7 Traceable pork using the TE-Food mobile appl. Source: Dang and Tran (2020, p 5)

Earlier research[29] in 2009 conducted field experiments (in conjunction with UN FAO) in the Hanoi area for safety branded and traceable free-range chicken in the context of Avian Influenza. The study used project farms that followed specific guidelines for safe production practices. The farms were supervised by local veterinarians and visited randomly as an additional control mechanism. The chickens had a non-reusable tag applied to one leg one week before slaughter. The chickens were sent to a registered slaughterhouse

[27] Dang et al. (2019) Vietnamese consumers' preferences for traceable food and safety attributes: The case of water spinach

[28] Dang and Tran (2020) Explaining Consumers' Intention for Traceable Pork regarding Animal Disease: The Role of Food Safety Concern, Risk Perception, Trust, and Habit

[29] Ifft et al. (2009) Valuation of Safety-Branded and Traceable Free Range Chicken in Ha Noi: Results from a Field Experiment

before being distributed to eight vendors in four retail wet markets. Market traders were trained on quality characteristics and marketing of the chicken and had to record all traceability information. The researchers applied systematic sampling in the areas surrounding the four markets and selected 1,200 households. Of the total sample size, 923 households participated in the survey interviews. They received a discount voucher redeemable in any of the eight traders in the four markets. The study confirmed that consumers would pay 1 USD more for safety branding and traceability in free-range chicken.

5 Vietnams' main export markets: A key driver for Safe and Traceable Food

Food safety and traceability are critical for establishing consumer trust and managing brand reputation in domestic and international markets. This is especially important in light of recurring foodborne disease outbreaks and food fraud scandals amplified by the mass media and social media. When combined with reputation, food safety and traceability can improve competitive positioning and trade performance, which are critical for a transitional economy like Vietnam. According to the World Bank's Safe Food Imperative report, Agri-food exports contribute to long-term "sustainable economic development and poverty reduction" (2019, p 6)[30].

The following countries/regions were selected for profiling as they form sixty-five percent of the F&V export markets for Vietnam. Exports of fresh produce classified as edible fruits, nuts, peel of citrus fruit, and melons totalled USD 5.5 billion in 2021 or 1.6 percent of Vietnam's total exports. Food safety compliance, country-of-origin traceability, and the ability to recall unsafe products are required for importing into these profiled countries.

Note: The information presented in this section is adapted from the pre-released World Bank report on "Digital technology for traceability in Vietnam's fruit and vegetable value chains." The report is expected to be published in late 2023.

5.1 European Union (EU)

Exports[31] of fruit and vegetables to the EU's member states are growing rapidly and reached USD 2.6 billion in 2021, or about twelve percent of Vietnam's global exports of F&V but still a tiny fraction of the total demand for F&V in Europe (0.1%)[32]. In 2022, the Vietnam Federation of Industry and Trade surveyed its members on the impact of the Europe-Vietnam Free Trade Agreement (EVFTA). The report noted that Vietnamese producers had difficulty meeting the country of origin and CE labelling rules.

In an article discussing the EU-Vietnam trade agreement, the Ministry of Industry and Trade (MOIT) spokesperson for European market development, Mr. Dinh Sy Lang, noted[33], *"Vietnamese enterprises can increase the export of vegetables and fruits to the EU, but they need to strictly comply with this market's regulations on traceability, quality standards, food hygiene and safety."*

EU consumers are considered mature and make purchasing choices based on personal values ranging from environmental protection to fair working conditions in the producing country. Hence, detailed labelling for the EU market is essential for consumer choice.

5.1.1 EU regulations on food traceability[34]

After the BSE outbreak - often called mad cow disease – and other incidents in the 1980s and 1990s, the EU reformed their food safety regulations to ensure a safer and more reliable food supply across its Member States. Traceability provisions are an effective measure that provides control authorities with pertinent information for rapid product recall in an emergency. The General Food Law, or Regulation (EC) No 178/2002, passed on January 28, 2002, serves as the legal foundation for food regulation in the

[30] The Safe Food Imperative. Accelerating Progress in Low- and Middle-Income Countries. World Bank (2019)

[31] With The EVFTA Agreement, why is it still difficult to export agricultural products to the EU?

[32] Vietnamese vegetables and fruit have many opportunities to penetrate deeper than the EU market

[33] With the EVFTA Agreement, why is it still difficult to export agricultural products to the EU?

[34] This section aligns closely with the World Bank report on Digital Transformation and Traceability in Vietnam written in conjunction with EY Vietnam for consistency purposes. The World Bank report is due to be published in early 2023.

European Union. Under EU law, all domestic and imported goods must be able to be traced back to their source.

Food traceability requirements are outlined in Article 18 of the General Food Law, starting with establishing food traceability at all production, processing, and distribution stages. Second, business owners must be able to identify the companies that provide the raw materials for their products and the locations to which their products have been delivered. They must be able to provide this information to the appropriate authorities upon request. Thirdly, food placed on the market must have adequate labels and identification to allow for traceability using pertinent records or data. The General Food Law is based on the "one step back / one step forward" traceability principle, which means that the information verifying the source and destination of a product or ingredient is recorded. Article 18 is generic and not considered prescriptive; it does not outline the type of data that the owner of a food and feed business must maintain or the minimum amount of time that records must be kept. Therefore, businesses and industry segments must decide what information to collect and keep track of, keeping in mind that failing to do so would be against the law and subject them to regulatory actions or penalties.

5.1.2 Detailed traceability requirements for high-risk products

The EU imposes mandatory requirements on several product categories that are considered high-risk, including products of animal origin and high-risk agri-products (e.g., sprouts). For food of animal origin, Regulation (EU) No. 931/2011[35] provides detailed (prescriptive) guidance on traceability requirements established by Regulation (EC) No. 178/2002. The regulation establishes the information that food business operators must make available to their customers and the competent authorities regarding food of animal origin consignments. In 2013, the EU issued Regulation (EU) No. 208/2013 on the traceability requirements for sprouts and seeds intended to produce sprouts. This regulation was enacted in response to a Shiga toxin-producing E. coli (O104:H4)[36] foodborne disease outbreak in May 2011, in which the consumption of sprouts was identified as the most likely cause of the outbreaks, which affected 3,816 people and caused 54 deaths. At all production processing and distribution stages, sprout business operators shall ensure information about batches of seeds intended for sprout production or the batches of sprouts is kept on records using the “one step back–one step forward” principle.

The EU established the Rapid Alert System for Food and Feed (RASSF) in 1979 and the Trade Control and Expert System (TRACES) in 2004 to track the movements of livestock to stop the spread of livestock diseases to ensure food safety, particularly traceability and recall effectiveness:

- RASSF[37] was further improved when the General Food Law was released in 2002. The rapid alert system permits the exchange of crucial product-related information whenever a member nation identifies a health and safety risk from food or feed so that immediate action can be taken.
- TRACES[38] is a multilingual online platform for traceability, information exchange and risk management. It is used for importing animals, animal products, food, feed of non-animal origin, and plants into the EU, as well as for domestic EU trade and EU exports of animals and certain animal products. Its main goal is the digital transformation of workflow and information exchange under the EU’s vision and strategy of “Shaping Europe's digital future” and streamlining the certification process and all associated entry procedures. TRACES offers a central database for tracking the movement of animals and animal products both inside and outside the EU. It makes it possible to quickly identify fake certificates, which helps to build trust and improve teamwork. TRACES ensures that all potentially impacted animals can be rapidly identified during a disease outbreak and that authorities can react

[35] https://www.lawinsider.com/dictionary/regulation-931-2011

[36] Epidemic Profile of Shiga-Toxin–Producing Escherichia coli O104:H4 Outbreak in Germany

[37] EU Rapid Alert for Food and Feed (RASSF)

[38] Trade Control and Expert System (TRACES)

appropriately. The parties involved are informed and given access to the pertinent documents whenever a decision or action is taken regarding a consignment.

- TRACES is used in over 90 countries, has 55,000 users, and is available in 35 languages.

5.1.3 Germany's Supply Chain Due Diligence Act[39]

German companies with over 3,000 employees are subject to a new law effective January 1, 2023, requiring due diligence in their global supply chain to ensure no human rights or environmental violations. The threshold for the number of employees will be reduced to 1,000 on January 1, 2024. In 2021, Vietnam exported nearly $1 billion in food products to Germany, including $564 million in coffee and spices, $143 million in fruits, nuts, citrus fruits, and melons, and $117 million in fish, crustaceans, molluscs, and aquatic invertebrates. In addition, meat, fish, and seafood preparations accounted for $82 million, and cereals, flour, starch, milk preparations, and products accounted for $32 million. Other food-related categories accounted for approximately $40 million. Vietnamese food business operators must be prepared for extensive risk audits by German buyers.

5.2 China

China is the primary market for Vietnamese produce. As recent as Q1 2017, China bought 73 percent of Vietnamese exports of fruit and vegetables[40]. However, due to several circumstances, including heightened regional competition, COVID-19's recent supply effects, and Vietnam's successful expansion of its international export market, China's imports of Vietnamese fruit and vegetables fell to 53.7 percent in 2021[41].

In the wake of numerous scandals involving food fraud and food safety, the Chinese government acknowledged the critical role that food traceability plays in controlling food safety. Numerous government-backed traceability initiatives have been developed over the past 20 years, emphasizing supply chain standards implementation and specific risks associated with food and agricultural products. For example, the Beijing Olympics used the GS1 standards for food traceability. Furthermore, as stated on GS1 China's website:

"Barcode applications have been extended to the food safety area with great efforts, and a number of food safety tracking and tracing system demonstrations have been established on a range of products such as Shandong seafood, Xinjiang cantaloupe, Yunnan pork, Sichuan tea, and the Hetian chicken of Fujian, this consolidates the critical role the barcode plays in our national food safety tracking and tracing system."[42]

5.2.1 China's Institutional Framework

The State Administration of Market Regulation (SAMR), the Ministry of Agriculture and Rural Affairs (MARA), and pertinent local government entities are part of the decentralized model that the Chinese government uses to control food traceability (from the national to the provincial level). The institutional framework for food traceability in China since its most recent restructuring in 2018 is depicted in the figure below.

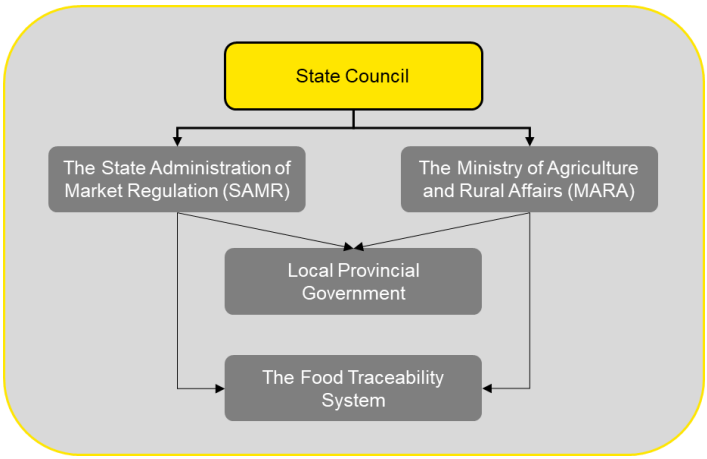
[39] German supply chain due diligence act https://library.fes.de/pdf-files/iez/18755.pdf

[40] China consumes over 73% of Vietnam's exported fruits, vegetables in first quarter: Ministry

[41] Vietnam: Fruit and vegetable exports welcome good news at the beginning of the year

[42] http://ancc.org.cn/GS1ChinaEN/GS1ChinaENTest/foodsafety.aspx

Figure 8 China's institutional framework: Source: EY Vietnam, World Bank Vietnam (2023)



The MARA launched the "National Agricultural Products Quality and Safety Traceability Management Information Platform" in June 2017. Like Vietnam's VNTP, the system is a government initiative to consolidate all traceability systems into a centralized database for improved regulatory control and monitoring. Data can be exchanged and shared across the national and provincial traceability platforms, allowing users to query comprehensive traceability data from a single interface. Agricultural product manufacturers, law enforcement organizations, food testing laboratories, and regulatory organizations use this system. The platform encourages government engagement because its primary objective is to assist these institutions in ensuring food safety. The system also provides the public access to a centralized query portal for instantly retrieving agricultural product traceability information. Various technologies are used in the system, including mobile apps, cloud-based ICT systems, and 2D barcodes.

China's Food Safety Law (FSL) was enacted on October 1, 2015. It establishes comprehensive statutory requirements governing the production, distribution, recall, and import/export of food products in the country. Additional regulatory requirements apply to different stages of food safety, according to the Resource Hub on Asia Pacific Law provided online by legal firm Baker McKenzie Vietnam[43].

- The Administrative Measures for Food Product Permits (2017) issued by the China Food and Drug Administration govern *food production* (CFDA).
- *Food trading* is governed by the CFDA's Administrative Measures for Food Trading Permits. The general rules apply to online food sales. Furthermore, in its Measures for the Investigation and Punishment of Illegal Conducts Concerning Online Food Safety, the CFDA has expanded on certain aspects of internet-based food-related conduct (2016).
- The Administrative Measures for Food Safety in *Importation and Exportation* (2011), issued by the PRC General Administration of Quality Supervision, Inspection, and Quarantine (AQSIQ) govern food import/export.

Additionally, China has created several obligatory rules for all commodities in its food traceability legislation. The government has prioritized high-risk and signature products and specific supply chains by implementing strict traceability rules[44].

- Meat and tea are considered high-risk/signature items
- Supply chains in e-commerce and the cold chain are prioritized
- Building the capacity of the inspection staff: Following the publication of national technical standards on traceability recently, the government trained its inspection workforce

43 Asia Food Pacific Food Law Guide: Baker McKenzie Vietnam. China Food Safety Legislation.

44 Digital Technology for Traceability in Fruit & Vegetable value chains in Vietnam. World Bank (pre-release Jan 2023)

- Issuance of provincial and national traceability systems, including (i) a national system for agricultural products and (ii) regional systems for meat and vegetable products

Furthermore, China encourages food producers and traders to develop traceability systems for food safety and to utilize QR codes to electronically capture, record, and share production and trading data. This technology is essential to the Chinese agri-food industry since it is extensively used and simple to use.

In May 2022, the Chinese province of Zhejiang (population 65 million) signed an agreement with GS1 China to migrate the province's food traceability and organized retail to 2D barcodes. In total, 7,000 food companies and 200 retail stores will participate in the initiative. It is expected that by the end of 2023, 80 percent of food producers in the province will have 2D barcodes on their products.[45]

5.3 Comparing the EU and China across regulatory, traceability and willingness to pay

Recent research data[46] compared (see Figure 9) traceability systems (TS) legislation and consumer preference for traceable food (see Figure 10) between China and the European Union. The authors note that the EU and China have significantly increased food trade, underpinned by robust traceability systems and safe food legislation. Regarding item one in Figure 9, 'food safety supervision and traceability legislation,' Vietnam is similar in that it has hierarchical food safety supervision, segmented supervision, and weak links between legislation and poor enforcement (see differences). In terms of 'perception and acceptance of traceability,' 90 percent of the sample size in China accepts traceability systems, far exceeding consumer demand for traceability in Vietnam.

Figure 9 Comparison of Traceability Systems between China and the EU. Source Qian et al. (2020)

Comparison of TS legislation, technologies and customer acceptance between China and EU.

Item	Similarities	Differences	
		China	EU
Food safety supervision and traceability legislation	1. Hierarchical food safety supervision; 2. Strict food safety legislation.	1. Segmented supervision by different institutions in supply chain; 2. Weak connections between legislations.	1. Sound legislations system across different institutions; 2. Risk assessment mechanism.
TS technologies and their application	1. Information technology framework based on production labeling and identification, supply chain data sensing and management, data exchange and query. 2. New generation information technology application synchronously	1. Technology research and application later; 2. Main TS application driven by government and enterprises.	1. System obstacle-free application in EU countries; 2. Playing an import role by trusted third party in system running.
Perception and acceptance of traceability	1. Research on consumer preference for traceable food and its influencing factors; 2. Product-specific and a country/region-specific.	1. Acceptance of TS by more than 90 percent of sample investigated. 2. Key factors on consumer age, educational level, safety perceptions, and the average product price.	1. Different willingness of pay more for TS in different countries; 2. Purchase traceable chicken and honey in France and Italy driven by attitudes.

[45] https://www.gs1.org/articles/gs1-2d-barcodes-gain-momentum-china

[46] Food traceability system from governmental, corporate, and consumer perspectives in the European Union and China: A comparative review. Qian et al. (2020. Trends in Food Science & Technology. 99, 402-412.

Figure 10 Comparison of consumer preferences for traceable food between the EU and China. Source: Qian et al. (2020, p 408)

Comparison of consumer preference for traceable food and its influencing factors between the EU and China.

Item	Country/ Region	Product	Content
Perception/acceptance/WTP for TS	The EU	Fruits/vegetables	Greece: Higher WTP for origin-labeled over products labeled with quality certification and traceability on how it was processed (Tsakiridou, Mattas, Tsakiridou, & Tsiamparli, 2011)
		Beef	Belgium: More emphasis on quality assurance and shelf life labeling than country-of-origin labeling or traceability information (Verbeke & Roosen, 2009)
		Meat	Germany: consumers relate traceability to more than origin. Traceability of meat associated with several production procedures and humane animal treatment (Lichtenberg, Heidecke, & Becker, 2008)
		Food, not special kind	France and Germany: Many willing to pay a premium for implementing a traceability program (Calvo et al., 2016) The Belgium consumers expressed more interest in labeling denoting quality and quality standards than traceability and origin (Loureiro & Umberger, 2007) Italy: consumers are strongly concerned with safety issues related to food chain controls and recall possibilities, whilst French consumers are more interested in quality aspects linked to quality labels and an indication of origin (Rijswijk, Frewer, Menozzi, & Faioli, 2008)
	China	Pork	Higher WTP for farming information and government certification of the authenticity of traceability information (Wu et al., 2017)
		Pork	Over 90 percent of respondents indicated that they considered that the TS was very necessary (Song, Liu, Wang, & Nanseki, 2008)
		Pork/milk/oil	Nanjing consumers are willing to pay a significantly positive price premium for food traceability despite some differences across food products. Most demand is for traceable milk, 21.7 percent higher than regular milk prices, followed by cooking oil (19.8 percent) and pork (16.7 percent) (Zhang, Bai, & Wahl, 2012)
		Fishery products	Consumers are willing to pay a premium of 6% for fishery traceability (Wang, Zhang, Mu, Fu, & Zhang, 2009)
Influencing factors	The EU	Chicken, honey	Attitudes drive the intention to purchase traceable chicken and honey in France, which is similar to Italy (Menozzi et al., 2015)
		Minced beef/beef steak	Attitude was the main determinant of intention to purchase, followed by subjective norm and PBC (perceived behavioral control) (Spence, Stancu, Elliott, & Dean, 2018)
		Agri-food, not special kind	Important factors = Confidence in provided information, perceived levels of convenience, impact on product quality and safety, impact on consumers' health and the environment, and potential consequences for ethical and privacy liberties (Chrysochou et al., 2009)
	China	Milk	Influenced by certification bodies, with highest preference for government certification, however, consumers with higher income and knowledge had a higher trust in third-party certification bodies (Bai et al., 2013)
		Pork/milk/oil	Consumer's knowledge of food safety certification can significantly affect their WTP (Zhang et al., 2012)
		Fishery products	Main Determinants = Age of consumers, educational level, the safety perception, and the average price (Wang et al., 2009)
		Food, not special kind	Income, education, and concern about food safety, have significant effects on consumers' willingness to pay a premium for a traceability certificate (Wu, Xu, & Gao, 2011)

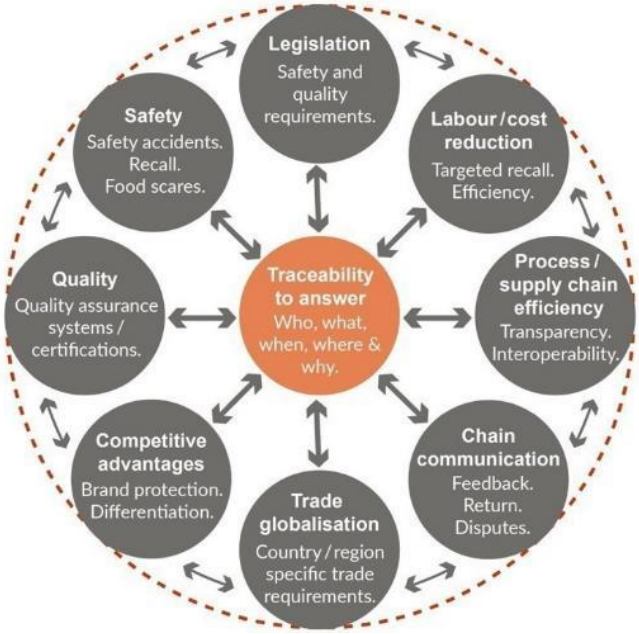
6 Introduction to Traceability

Traceability is a fundamental requirement for a robust food safety management system. To safeguard the health and safety of consumers, regulatory frameworks require traceability and the capability to recall unsafe foods for both domestic distribution and imports and exports. Additionally, a traceability system supports numerous claims about a food product and production methods, including VietGAP, organic, and grass-fed, frequently made in food products (Caveen et al., 2021)[47].

6.1 Traceability Drivers

Because SAFEGRO is fundamentally a food safety project, the scope of the traceability gap analysis is limited to the critical traceability functions that support food safety. Within that context, the image below in Figure 11 depicts the key drivers of traceability, which include regulatory compliance, product safety, product quality and claims management, product origin (provenance), and increasing consumer transparency and trust. The gap analysis does not explore ESG/CSR drivers.

Figure 11 Traceability Drivers: Source: Caveen et al. (2021) adapted from source Aung and Chang (2014)



Consumer demand for safe food

Food safety and quality issues have moved to the forefront of consumer concerns, industry strategies, and government policy as consumers have become more discerning in their food choices. Several private-sector and public-sector traceability initiatives have emerged to reduce consumer information asymmetry regarding food safety and quality attributes. Food safety has become more critical, particularly as quality dimensions and consumer choices have expanded.

Regulatory Compliance

Product protection and consumer safety are key drivers for developing traceability regulations, as are reimbursement: improving payment, monitoring, and preventing reimbursement fraud; supply chain visibility and efficiency; recall improvement; returns, shipment accuracy, and efficiency.

[47] Caveen et al (2021) Adapted from Aung and Chang (2014) The impact of improved traceability on the safety of food

GS1 standards are essential in facilitating end-to-end traceability and aiding the industry to comply with regulations. Data that is structured, collected, and shared consistently is more likely to be effective in solving traceability challenges and is critical in assisting all supply chain stakeholders in *seeing* where the product is currently, where it has been and where it is going (e.g., its supply chain visibility). Creating a common language and procedures allows for sharing at all levels of the supply chain. It improves the interoperability of hardware and software solutions. This strategy will necessitate complete operational/financial commitment from all supply chain companies.

The UK Food Standards Agency has stated the following benefits of improved traceability and issued a best practice guideline[48];

- To support food safety and/or quality objectives and meet customer specification
- To fulfil local, regional, or international regulations or standards, as applicable
- To communicate information to relevant stakeholders and consumers through the provision of reliable information to regulators, customers, and consumers
- To improve consumer protection through better-targeted and more rapid recalls and/or withdrawals
- Greater efficiency within businesses, with more information to assist in process control and management, e.g., in stock control and quality control
- To support authenticity claims about products, e.g., to authenticate origin and production claims and deter fraud.

6.2 Traceability definitions

Many traceability definitions are available across industry, academia, international standards organizations, and regulations. Governments generally follow Codex Alimentarius (Codex) food safety standards and guidelines. The Codex definition of traceability in the Codex Procedural Manual (FAO/WHO 2013: p 25)[49] is a good starting point.

> *"the ability to follow the movement of a food through specified stage(s) of production, processing and distribution"*

However, as argued by Olsen and Borit (2013, p 143)[50] "this definition reduces traceability to the following of the movement only, and if taken literally, this definition is very different from all the others outlined [here] which use at least potentially more comprehensive verb phrases."

In Table 1, Olsen and Borit compare the completeness of traceability definitions, verb phrases and product properties, including the Codex definition, which is missing the "trace how" in their evaluation.

[48] UK Food Standards Agency best practices for traceability and recall https://www.food.gov.uk/sites/default/files/media/document/food-traceability-guide.pdf

[49] Codex Alimentarius Commission Procedural Manual. Twenty-first edition (2013)

[50] Olsen and Borit (2013). How to define traceability. Trends in Food Science and Technology 29, 142-150

Table 1 Comparison of traceability definitions. Source: Olsen and Borit (2013, p 147)

Table 4. Selected traceability definitions broken down in constitutive elements.

Defined in	Verb phrase	Product properties	Trace what	Trace where	Trace how
ISO 8402	Trace	History, application or location	An entity	–	By means of recorded identifications
ISO 9000 and ISO 22005	Trace	History, application or location	Of that which is under consideration	–	–
Codex	Follow	Movement	A food	Through specified stage(s) of production, processing and distribution	–
EU GFL	Trace and Follow	–	A food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed	Through all stages of production, processing and distribution	–
Moe (1998)	Track	–	A product batch and its history	Through the whole, or part, of a production chain from harvest through transport, storage, processing, distribution and sales or internally in one of the steps in the chain	–

Table 2 is an excerpt from Aung and Chang (2014, p 174)[51] that compares various traceability definitions, including the traceability definition from Olsen and Borit. Notably, Aung and Chang use and extend Olsen and Borit's comparison framework, adding additional dimensions to reflect "trace where," "trace why," and "trace when."

Table 2 Summary of comparisons between traceability definitions

Comparison chart for selected definitions of traceability.

Define in	Traceability?	Trace what	Trace how	Trace where	Trace why	Trace when
ISO 8402	Ability to trace	An entity (origin/history/location)	By means of recorded identification	–	–	–
ISO 9000	Ability to trace	An entity under consideration (origin/history/location)	–	–	–	–
EU Regulation (178/2002)	The ability to trace and follow	A food (or ingredients of food)	–	All stages of supply chain	–	–
CAC	The ability to follow	A food	–	All stages of supply chain	–	–
Wilson and Clarke (1998)	Information necessary about a product	A food crop (i.e. Agri-food)	–	From the grower to the consumer's plate	–	–
Dalvit et al. (2007), McKean (2001)	A system able to maintain records about products	Animal or animal products	–	From farm to retailer	–	–
Olsen and Borit (2013)	The ability to access any or all information	A food	By means of recorded identification	Entire life cycle of food	–	–
Bosona and Gebresenbet (2013)	Part of logistics management that capture, store, and transmit adequate information	A food, feed, food-producing animal or substance	–	At all stages in the food supply chain, traced upward, and tracked downward	For safety and quality control	At any time required.

The following traceability definitions are common in Vietnam, starting with the joint definition by GS1 / ISO 9001.

- GS1 / ISO 9001:2015 “Traceability is the ability to trace the history, application, or location of an ‘object’ (e.g., product). When considering a product or a service, traceability can relate to (i) origin of materials and parts; (ii) processing history; (iii) distribution and location of the product or service after delivery.”[52]
- Vietnam Law on Food Safety Clause 28, Article 2: Traceability is “tracing the process of forming and circulating food.”
- The Law on Fisheries, Clause 27, Article 3: Traceability of aquatic products is the tracking and identification of a unit of aquatic product through each node of the process of fishing, aquaculture, processing and trading.

[51] Aung and Chang (2014) Traceability in a food supply chain: Safety and quality perspectives. Food Control 39, 172-184

[52] Digitalisation of Conformance and Accreditation Processes (2022), p. 8. https://nata.com.au/supplychain/

- National technical standard TCVN 12850:2019: "Traceability is the ability to identify a product/service unit throughout each stage, time, location of production, processing, storage, transportation, distribution, and selling processes."

6.3 Traceability: General principles and aims to support product safety

A traceable object must be uniquely identified and have its supply chain process path captured, recorded, and shared. Traceable objects can include loose and packaged produce, cartons, and reusable food transport containers. Operators in the food industry must collaborate and agree on what must be uniquely identified and traced within their value chains. A traceable object can be a product or traded item (e.g., a case/carton or a consumer item), a logistic unit (e.g., a pallet or transport container), a shipment or movement of a product or trade item, or an asset (e.g., re-usable tote, crate, bin).

At its most basic, traceability has an internal and external dimension, as illustrated in Figure 13. A food business operator (FBO) must identify their trading partners to perform product traceability in a one-step forward (downstream clients) and one-step backward (upstream suppliers) manner. Suppose a product is deemed unsafe and requires a recall or withdrawal. In that case, an FBO must be aware of and have documented the product's ingredient sources (traceback, see Figure 14; track forward, see Figure 15). Traceability enables stakeholders to rapidly locate a product at any point in the food processing and distribution supply chain. When a safety hazard is discovered, traceability assists in determining where the product and its ingredients (if a processed product) originated and to which business the product was sold, ensuring that additional contaminated products do not reach consumers.

To answer the question, "What is the difference between the GS1 barcode and the barcode that the enterprise or the organization owns?" Figures 14 and 15 highlight internal and external traceability. Internal traceability shows the item flow (from the raw materials through the processing to the finished product and packaging), the information flow within an enterprise or an organization, etc. For example, the traceability process of a rice manufacturing cooperative, Gao Phu Thien, is in Figure 12.

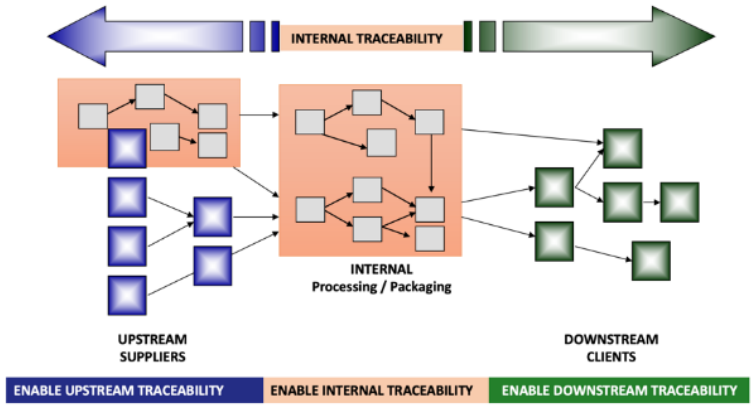
Figure 12 Gao Phu Thien mobile supply chain app.

The internal traceability of Gao Phu Thien cooperative includes the following processes: paddy procurement, paddy drying, inventory, dry paddy sale, milling-packaging, and agent distribution. External traceability shows the product flow or information flow through the supply chain. Subsequently, reliable traceability data can be produced by collaborating and coordinating all the stakeholders in a supply chain.

While firms can use a barcode created for internal purposes only, this type of barcode doesn't need to have the function to capture product, location or brand identification. External traceability begins when a product is physically exchanged from one trading partner to another. During this process, the GS1 barcode is helpful for the transactions and identification of products flowing between the organizations in a supply chain. Various GS1 barcodes and labels on products, containers, and pallets enable all traceable items to be uniquely identified, and information can be shared between all supply chain participants. Pertinent data is recorded on product labels and related paper or electronic documents, enabling standards-based

communication across a distribution channel. This links the physical products with the information requirements necessary for traceability.

Figure 13 General principle: Internal and External Traceability. Source: Adapted from GS1



Food traceability is a practice and a tool to follow the journey of food products and ingredients through every process step and transaction in the supply chain. Digital traceability solutions record and link the production, processing, and distribution chain of food products and ingredients, enabling faster recalls and responses to outbreaks.

Figure 14 Traceability – Tracing. Source: GS1

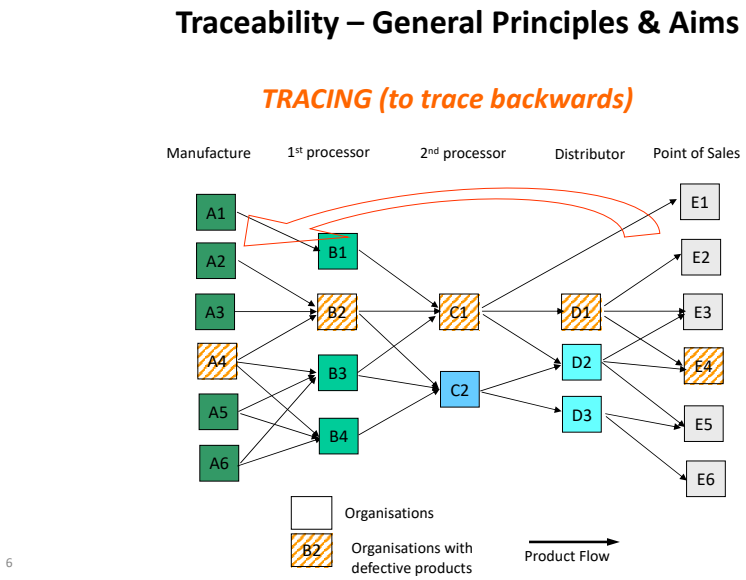


Figure 15 Traceability – Tracking. Source: GS1

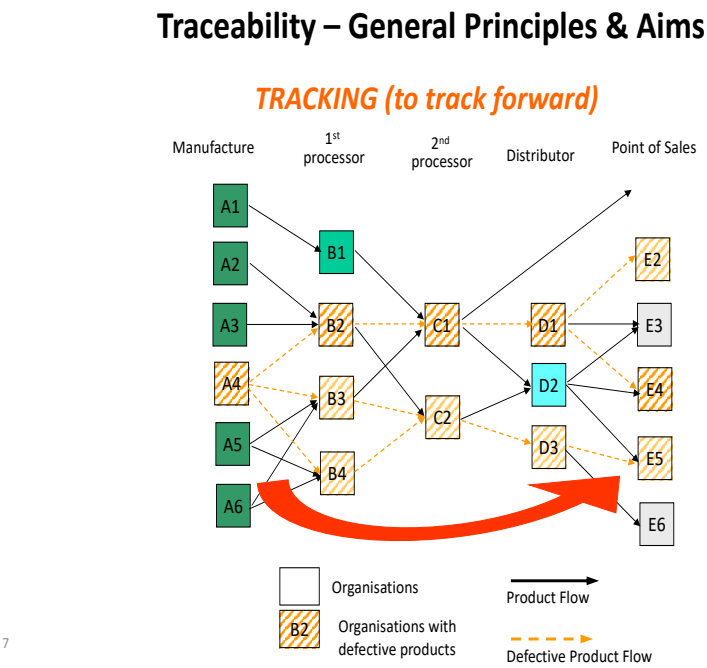


Figure 16 depicts an end-to-end fruit and vegetable traceability system that incorporates the internal and external traceability required by each stakeholder. This model distinguishes between product flow and information flow. Figure 17 depicts the traceability data that must be collected and stored at each value chain stage, from the primary producer to the selling stage. This reflects the flow of information to support internal and external traceability and recall management.

Figure 16 Fruit and vegetable product and data flows for end-to-end traceability. Source: GS1

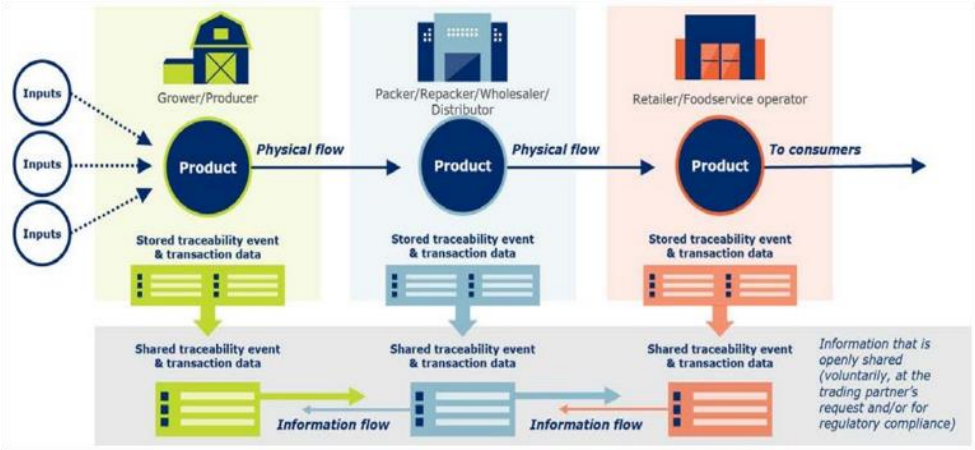
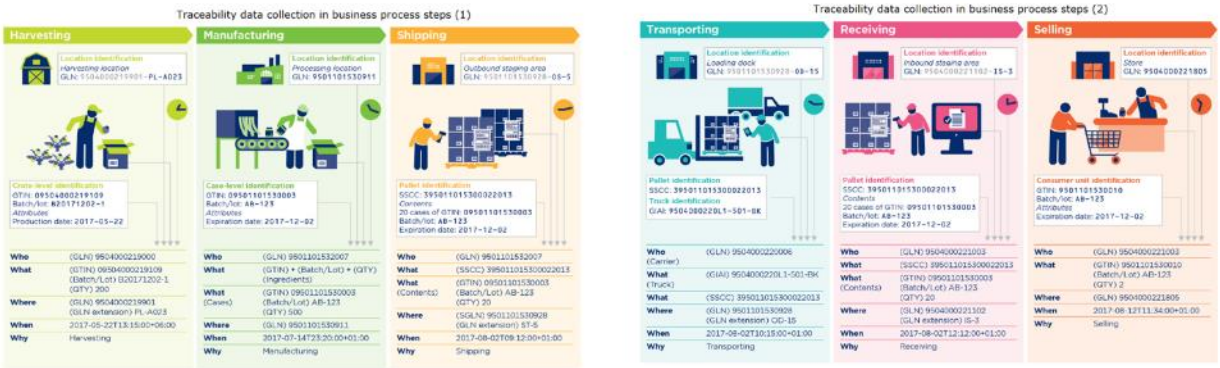


Figure 17 Traceability data collection in F&V value chain process steps. Source: GS1



6.4 GS1 standards in traceability

In the global supply chain, the standards developed by the industry are managed by GS1. The Global Trade Item Number or GTIN is the most well-known GS1 "key". It is usually mandatory to uniquely identify retail products in supermarkets or online marketplaces. Agri-food businesses use other identification keys for different operational purposes. For example, a GLN or Global Location Number and SSCC or Serial Shipping Container Code are the common identifications developed by GS1 and recognized by ISO and IEC standards. Trading partners rely on these identification keys to exchange physical goods, services, and trading information (invoice, purchase order, etc.).

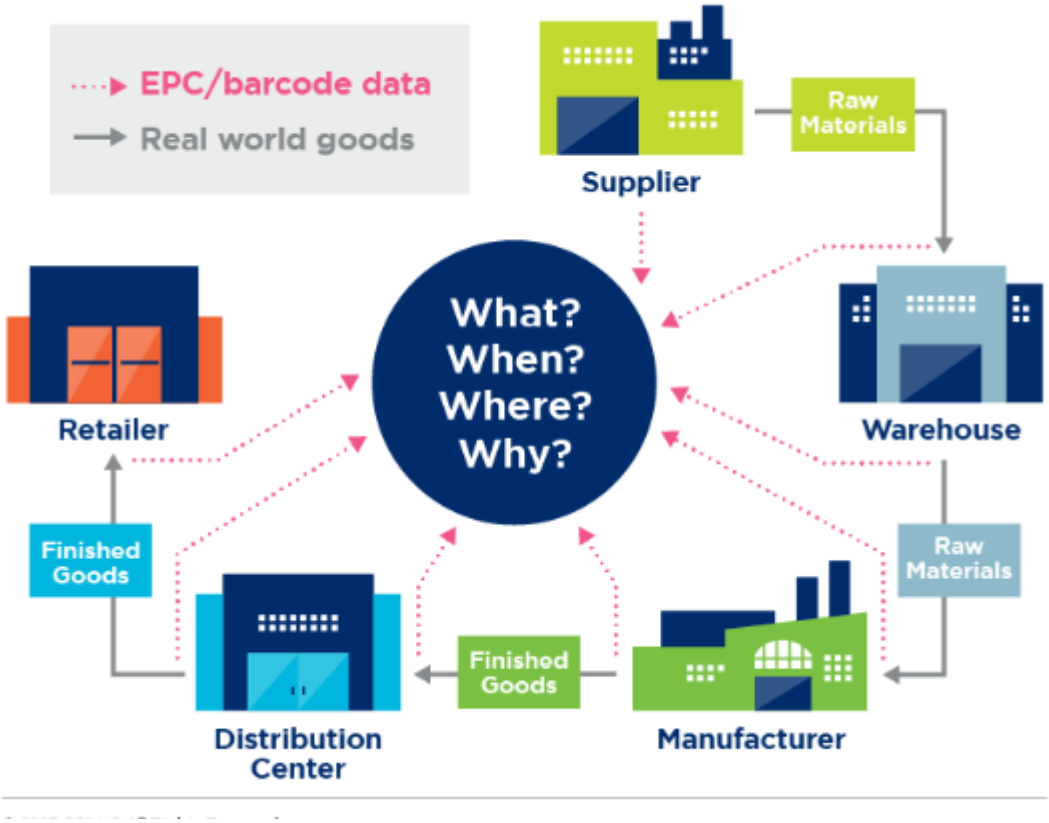
These object-identifying keys are encoded into barcodes or radio frequency identification tags (RFID). The barcode represents a number (containing only digits) or a string (containing letters and digits). This representation is needed for the Automatic Identification and Data Capture (AIDC) system for automatic data acquisition by electronic devices, such as barcode scanners or cameras. The most popular barcodes are from the GS1 family, such as EAN/UPC (ISO/IEC 15420), GS1 DataBar (ISO/IEC 24724), GS1-128 (ISO/IEC 15417), DataMatrix (ISO/IEC 16022).

Various standardized identifiers (keys) and barcodes serve different trading purposes, including traceability. Traceability relies on globally unique identifications to link the Critical Tracking Events (CTEs) and Key Data Elements (KDEs) occurring within one party and all participating supply chain parties. A traceability system is effective when products can be completely traced across the supply chain using globally unique identifications. Standards-based object identification systems enable the linking of tracking events. Each tracking event provides information about who, what, where, when, and why.

- "Who" refers to a party or organization responsible for an event
- "What" identifies the product. Products are already assigned a product code that can be read using barcode scanners.
- "When" shows the time at which the business process involving the product occurred
- "Why" is the business context in which the product was handled, providing an indication of the business process involved
- "Where" includes the data for the physical location or legal entity where the product was processed.

GS1 also has standards for sharing information electronically, eliminating the need for manual re-keying and improving accuracy and efficiency in business communications. For example, its Global Data Synchronization Network (GDSN) for static product data sharing, EDI, XML for business messages and document sharing, and EPCIS for event data sharing. EPCIS is a joint ISO/GS1 standard that allows trading partners to share information about products' physical movement and status as they move through the supply chain, generating records through "Event Data" to answer the traceability questions who, what, where, when, and why. Event data can be shared across disparate technology systems and businesses, which significantly benefits traceability, regulatory monitoring and consumer requirements.

Figure 18 GS1 standards help to address who, what, when, where and why. Source: GS1



Using GS1 standards, each product, location and party can be uniquely identified, and data can easily be captured at all points in the value chain and shared with multiple parties and businesses. Through accurate identification, capturing, and sharing, the GS1 System is an integrated suite of technology-neutral global standards that enables supply chain visibility, traceability, and recall. The GS1 standards and guidelines related to traceability are:

Year of publication	Document name
2021	Global Traceability Compliance Criteria Standard, Release 4.1
2021	GS1 Fresh Fruit and Vegetable Traceability Guideline
2019	GS1 Foundation for Fish, Seafood and Aquaculture Traceability Implementation Guideline, Release 1.3
2017	Global Traceability Standard, Release 2
2015	Global Traceability Compliance Criteria for Food (Application Standard)
2015	GS1 Made Easy - Global Meat and Poultry Traceability Guideline Companion Document
2015	GS1 Global Meat and Poultry Traceability Guideline, Part 1. The GS1 System

2015	GS1 Global Meat and Poultry Traceability Guideline, Part 2. Beef Supply Chain
2015	GS1 Global Meat and Poultry Traceability Guideline, Part 3. Lamb and Sheep Meat Supply Chain
2015	GS1 Global Meat and Poultry Traceability Guideline, Part 4. Pork Supply Chain
2015	GS1 Global Meat and Poultry Traceability Guideline, Part 5. Poultry Supply Chain
2005	Wine Supply Chain Traceability (Application Standard)

7 Traceability & Recall in Vietnam's regulations

In Vietnam's regulatory system, traceability and recall have been regulated by Laws, Decrees, Circulars, and National Standards. The mandatory requirements for traceability are regulated by normative documents (Laws, Decrees, and Circulars). In contrast, national standards (TCVNs) are voluntary and unenforceable. Notably, the Law legalizes the general principles of traceability, a Decree provides further clarification and implementation of the traceability process, and a Circular provides detailed implementation guidance by the relevant Ministry. The national standards are prescriptive and provide the specific technical requirements for traceability.

In Vietnam, a Law provides general rules with binding force. For example, the Law on Food Safety, in Articles 54 and 55, provides specific information for traceability, recall and handling of unsafe food. In implementing these provisions, detailed guidance is provided in Chapter XI of GoV Decree 15/2008/ND-CP; MOH Circular 23/2018/TT-BYT, Circular 25/2019 and the MARD Circular 17/2021.

The Law on Livestock mandates that feed producers are responsible for developing and implementing animal feed quality control processes that ensure traceability. Feed traders and importers/exporters are responsible for recording/documenting and maintaining records of animal feed during the trading and exporting process to ensure traceability. Livestock farms must keep records/dossiers about the livestock operation, the use of veterinary drugs, vaccines and other information. Slaughterhouses must keep documents on the origin of the livestock to ensure the traceability of animals brought to slaughter. Livestock products traded and preliminarily processed must have origins recorded to ensure traceability.

The Law on Fisheries stipulates that the hatcheries and nurseries, both organization and individual, are responsible for keeping records/documents about the aquatic hatchery and nursery process to ensure traceability. Aquatic feed producers, traders, importers/exporters and users, both organizations and individuals, are responsible for the labelling of aqua feeds and environmental treatment products in accordance with the law on labelling of goods for traceability. Aquaculture producers, organizations and individuals, must keep records of aquatic breeds, feeds, aquatic veterinary drugs and aquaculture environment treatment products used in the aquaculture process and documents about the entire process to ensure traceability. The Law on Product Quality only prohibits the export, import, purchase and sale of goods of unknown origin. It provides that sellers must check the origin of goods and labels. However, it does not specifically provide guidance on product traceability – and this law is under revision to provide for more specific regulations on traceability.

Government Decree No.13/2022/ND-CP dated January 21st, 2022, clearly provides for the responsibilities of specific line ministries under the Framework of national traceability, under which MOST shall take the lead in state traceability management. Under Decision 100/QD-TTg dated 19/1/2019 regarding approving the Proposal for implementation and application of a national product traceability portal, MOST is assigned to develop a National Product Traceability Portal. MOST is to assist and engage with line ministries and provinces and is responsible for developing and managing the national product traceability portal (VNTP). Within their assigned responsibilities for food safety, each Ministry must create and execute a traceability plan and identify the list of products that must be traceable.

With regard to the national technical standards, MOST published twenty national standards (TCVN) related to traceability. TCVN 12850 – "General requirements for traceability system" is the framework for implementing a traceability system. In addition, other TCVNs, such as TCVN 12827 for fresh fruit and vegetables, TCVN 13166 for meat and poultry, and TCVN 13167 for compliance, were published to detail the implementation of a traceability system in specific supply chains.

The list of documents is reflected in Annex 2.

8 Field visit findings: High Level (detailed findings in meeting notes)

The following sections detail the initial findings in each market segment where the traceability team engaged stakeholders. The background evidence for this section is in minutes/notes from meetings, questionnaire responses and photo/video evidence too large to include in this report.

8.1 Informal wet markets – wholesale and retail

There was an observed difference in governance, organization and functioning of wet markets between the north and south of Vietnam. Markets in Ho Chi Minh City were observed as more modern and organized than in Hanoi. The following main findings apply to all wet markets.

- Digital traceability is not applied in traditional wet markets, and manual traceability is weak or non-existent.
- There is a lack of traceability demand from buyers in wholesale and retail wet markets. Buyers develop relationship bonds with farmers over time. They are deemed more knowledgeable and transparent in sharing information about the product's origins and production (versus traders who buy produce from collectors or meat from wholesale markets).
- The supply side views traceability and labelling as adding unnecessary costs.
- There is little incentive regarding traceability requirements for wet market traders.
- Containers, including plastic totes, boxes and cartons/boxes used for supply chain transportation, are reused numerous times. Labels applied for traceability purposes could misidentify products and their sources.
- There is a time lag between sampling and receiving test results from the appropriate authorities (8-24 hours). Because of this time lag, if foods are deemed unsafe, they will have been sold and most likely consumed, making a possible recall notice unnecessary (and impossible).

The traceability team visited the Minh Khai wholesale and Den Lu wet markets in Hanoi on 12/11/2022.

- Due to poor growing conditions for certain produce in northern Vietnam, traceability is more complicated in the Hanoi wet markets during the fall and winter seasons. The mission was told in one market that up to 40% of fresh produce was from China and had no traceability records. According to the management board member we spoke with, the products should have been tested and cleared at the border upon entry into Vietnam and thus deemed safe for distribution.
- Chinese tubers and vegetables are packed in PE or mesh bags, labelled in Chinese only.
- The management conditions to facilitate product traceability at the market have not been arranged.
- The selling area has been divided into separate stalls. Still, stalls have limited signage to inform buyers of the name, address, and phone number of stall owners/traders; stalls are arranged by product, without any information on product type, origin, harvest date, expiry date, instructions for storage and user.
- Sellers do not keep notes/record books on buying and selling the products. While many small traders have registered their business with the Market Management Board, freelance trading households select plots/areas to sell products. The number of these freelance households' traders is large, and they trade their products at a time when the registered small traders have not started their trading activities yet.
- In addition to stalls that sell fresh tubers and vegetables, some stalls sell beef, chicken, and pork. However, there is no information on the product's origin or labelling; hence, it's impossible to trace the product's origin.
- After interviewing some shoppers at the market, they said they did not care much about the product's origin but focused on the freshness and price. The price of vegetables there is very low; for example, 1kg of morning glory costs 5,000 VND.

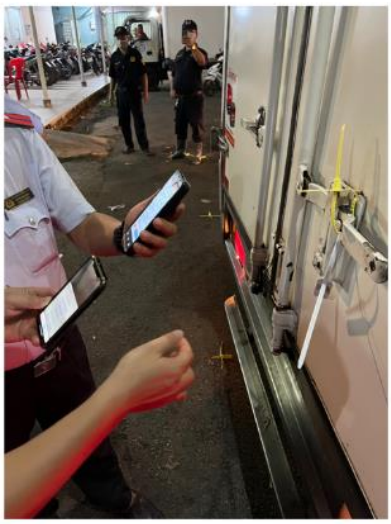
The traceability team visited **Binh Dien Wholesale Market** in Ho Chi Minh City on December 7, 2022. The general findings are as follows:

- The market is considered a showcase for wholesale wet markets in Vietnam. It is well-structured and organized (see an aerial photo of six warehouse units). As seen in Figure 19, the traders have prominent signage and contact details, a starting point for traceability.

Figure 19 **Image of Traders signage and aerial view of Binh Dien wholesale market**

- The Ho Chi Minh City Food Safety Management Board has communicated regulations on traceability to traders at the market, along with providing them with (annual) training on food safety information.
- For pork received at the market, pigs are slaughtered, cleaned, halved, and transported to the market in small trucks. Both halves of the pig carcass have traceability tags on each rear leg. Traceability tags remain on the pig's legs until the carcasses are cut into smaller portions. There is no traceability beyond this processing point. See the photo below.
- The delivery trucks have security tags applied to the doors to prevent more products from being added during transportation. The tags are scanned using a handheld scanner by the market's competent authority. The information recorded includes the license plate of the transport vehicle, the farming establishment's name, the slaughterhouse's name, the wholesale agent at the market, information on disease control, slaughter line, and slaughter date. See Figure 20.

Figure 20 Pork transportation, animal tagging and truck security tags



- For vegetables and fruits: under the guidance of Binh Dien Market Management and Trading Company, smallholder traders must keep traceability records in their books, with daily product information inputs on product type, quantity, origin (by province), suppliers' information (name, address, and phone number), and buyers' information (name, address, and phone number). However, recorded information on sales volume is inconsistent with the quantity of products supplied (large volumes of supplied goods but recorded sales figures are negligible, at about 50% of the amount provided; for some products, there is a lack of sales data on various dates. Supervisors and verifiers have not signed most of these traceability monitoring records.
- During the interviews, the traceability team learned that damaged/unsellable/waste is around 10%.
- Very few vegetables sold at the market have traceability QR codes on their packaging. For the few products with the QR codes, the information returned when these were scanned mainly advertising for product purchase, and there was not enough information to trace the origins of the products.

In August 2022, the traceability team visited the **Thu Duc wholesale wet market** in Ho Chi Minh City. The following are the main findings.

On average, 250 x 10-ton trucks arrive at the market daily with a total volume of +/- 2,500 tons. Approx. 10% or 250 tons end up as organic waste daily, costing the market 500m VND monthly for disposal (approx. USD 21,400).

Traceability

The Management Board noted that 95% of the fruit and vegetables in the market are untraceable. They claimed that there are gaps in regulations and enforcement for traceability.

- Ordering
  - Stall owners use tools like Zalo to pre-order from collectors.
  - Collectors buy from various farms and/or co-ops.
  - Collectors can be an individual or a company that trade in the market.
  - Farmers/co-ops harvest at 5 p.m., and the produce is picked up, commingled, and driven to HCMC early to ensure freshness.
- Delivery
  - Trucks arrive at the market with a registration form with little information and could be as little as 'potatoes from DaLat.
  - The site services include delivery from the trucks to the stalls.

- Imported products in the market from China have basic identification (garlic "product of China"). In contrast, many brands of apples from Australia, New Zealand and the USA (photo) have formal trade identification and GS1 barcodes.

Figure 21 Product packaging using GS1 standards from USA and Product of China on garlic

  - Distribution
    - Formal retail buyers may ask for certifications like VietGAP but do not ask for labelling.
    - Packaging throughout the supply chain process, which could include labelling, is often reused.
  - False declaration of quality and origin
    - The Management Board noted various food frauds, including low-cost Chinese potatoes sold by collectors as DaLat potatoes. The same issue occurs with mangoes and other lower-quality fruits and vegetables sold from areas known for high quality.
- The Management Board cautioned that if they mandated improved traceability, the 'trucks' would go to other markets with no restrictions.
- The Management Board shared that labelling increases costs, and traders always buy the cheapest products.
- The market has 1,200 stall owners. According to the Management Board, the traders who sell on the ground outside the main buildings are extensions of the licensed traders. However, we learned from other sources that these might be unassociated with the licensed traders and reflect local smallholder traders. See Figure 22.

Figure 22 Images of informal trading outside of the markets

- Ten stalls have formal brands, staff uniforms and some form of traceability.
    - Stall owners pay 70,000 VND per sq meter per month (USD 3).
    - The average stall size is 20 square meters.
- The services provided by the Management Board include;
    - Delivery services to the stalls from the trucks
    - Site Security
    - Lighting
    - Waste disposal
    - Disinfection sprays
    - Pest control

Figure 23 Images of stall signage

On December 7th, 2022, the traceability team visited the **Pham Van Hai retail wet market** in Ho Chi Minh City. The following are the main findings.

- The Ho Chi Minh City Food Safety Management Board has communicated regulations on traceability to small traders at the market, along with providing them with (annual) training on food safety.
- Goods sold at this market are supplied by wholesale markets such as Binh Dien and Tan Xuan (in Hoc Mon) or come from neighbouring provinces, including Long An, Dong Nai, Tien Giang and Tay Ninh.
- About twenty percent of the goods in this market are sold to retailers, and eighty percent are sold directly to consumers, restaurants, and collective kitchens.
- Under the guidance of the Pham Van Hai Market Management Board, small traders have traceability notebooks. The information recorded in the book includes the date of goods receipt, name of the goods, their quantities, the name, address, and phone number of suppliers, and signed for goods receipt. The records have pre-printed information about the goods' names, addresses, and phone numbers of suppliers. However, the information that needs to be recorded daily by hand, such as the date of goods receipt, their quantity, and the signature for delivery and receipt, is not filled in.
- We observed a very good practice where stalls have colour-coded signage by commodity (e.g., meat is red, dry goods are green) with the traders' contact details and whiteboard for daily market prices. See figure 24

Figure 24 Examples of good practice in trader signage

8.2 Formal (retail) markets

The traceability team conducted a combination of informal and formal site visits and surveys at several supermarket chains in HCMC and Hanoi, including Aeon-mall in Long Bien and Ha Dong, TOPS Market in Thao Dien Pearl (HCMC) and Ha Dong, Mega Market in An Phu, HCMC and Pham Van Dong, and Winmart in Hanoi. The team also visited the retailer chain Bách hóa Xanh in HCMC.

The general findings are as follows:

- Organized retail in Vietnam has made remarkable progress over the past five years with significant visual improvements in in-store signage, packaging, labelling, and usage of GS1 standards and QR codes for traceability.

Figure 25 Examples of good practices in signage, packaging & labelling for food quality and traceability in formal retail

- Many fruit, vegetable, and meat products are labelled with QR codes for traceability and GS1 barcodes for point-of-sale scanning. When screening QR codes, we could find information on the product name and image, manufacturer's name and address, and instructions for use and preservation without information about various actors involved in different nodes along the value chain from production, collection, preliminary or semi-processing, slaughtering, processing, and distribution of products. However, screening the QR code of chilled pork with the Meat Deli brand name showed the information on the name and address of the livestock establishment and the slaughterhouse in the pork value chain.

- For some fresh vegetables and pork displayed in Aeon Mall Ha Dong and Aeon Mall Long Bien, these supermarkets use their in-house barcodes for managing goods and processing the payment at the point of sale, but they are not intended for traceability.

- We observed a poor traceability labelling practice where two QR codes were attached to several CP-branded chicken products. Upon scanning the codes, they returned different information, confusing consumers. Some other products had more than one linear barcode.

Figure 26 Examples of isolated bad practices with 2 QR codes on chicken products in formal retail

- Some supermarket systems, including Winmart and Mega Market, are developing their e-Traceability system, which applies to the fresh vegetable chains. Products can be traced back to household-based farmers who are members of cooperatives using smartphone traceability software. The software has templates/information boxes for farmers to update information on the production and harvesting process; their Cooperative has a traceability code for each farmer; the harvested products sold in supermarkets show complete traceable information when a consumer scans the QR code on the product label. However, the most significant constraints when implementing traceability are the farmers' habits regarding note/bookkeeping, the ability to access and apply information technology, and the fact that farmers may not be fully aware of the immediate benefit of traceability. For the pork chains, MM Mega Market and Meat Deli (Masan Group) have developed and been operating a very effective traceability system, with transparent traceable information along the chain, from livestock farms through slaughterhouses to distribution establishments.

- The traceability team briefly interviewed several consumers at Aeon Mall in Ha Dong and Long Bien. Consumers choose a product (meat) mainly based on appearance and their sensory observation (smell) - they look at the packaging, product design, freshness, colour, meat muscle elasticity, the information written on the product labels, product certification (VietGAP), etc. They did not pay much attention to signs for traceability, such as QR codes and GS1 codes. Consumers have not yet developed a habit of checking the traceability information of products through scanning QR codes/GS1.

- We noted a global best practice at the Ho Chi Minh City-based retailer Bách hóa Xanh. After detecting an unsafe product, they can block all point-of-sale devices in over 1,700 retail stores. This world-class capability is similar to the Korean government's cross-ministerial solution with GS1 Korea. All points of sale in Korea are blocked within 30 minutes of the government notifying retailers that a product is

unsafe to sell. In this case, the GS1 barcode and its embedded global trade item number are blocked, protecting consumers from harm.

Figure 27 Examples of food display, signage and chilled storage

8.3 Slaughterhouses / pork processors

The traceability team visited pig slaughterhouses and pork semi/preliminary processing facilities in Hanoi: **Song Dat Food Joint Stock Company** and **Hoang Long Cooperation** and observed the full process from animal slaughter to meat processing, packaging, and labelling. Below are the key findings:

- These two establishments carry out the slaughtering, slicing, and packaging of pork and sell it to supermarkets, such as Aeon Mall Ha Dong, Aeon Mall Long Bien, and the communal kitchen at Ha Dong General Hospital.

Figure 28 Photos of various stages of processing and production at Song Dat

- Pork products are prepared in whole or half-body carcasses supplied to supermarkets (Aeon Mall Ha Dong, Aeon Mall Long Bien).

- The products supplied to industrial kitchens, collective kitchens and retail stores are sliced and stored in returnable tote containers attached to the establishment's name but without product labels. See Figure 28.

- The establishment's knowledge of traceability, recall and disposal of unsafe food: through the interview, the establishment owner (Song Dat) and QC staff (a newly recruited staff) showed that the establishment has knowledge of traceability and provided cases where recalls are triggered when a product fails to meet the sensory quality check requirements.

- Hoang Long is a vertically integrated value chain with a retail outlet (as well as selling to supermarkets). See Figure 29.

Figure 29 Various stages of processing at Hoang Long

- For both processors, if there is a complaint about food safety, the establishment and the customer take samples; the processor keeps one sample, and the other is sent to a laboratory for analysis. Based on the analysis results, they may agree to recall and dispose of products when chemical and antibiotic residues are detected.

- Both establishments need to be updated on the regulations on traceability, recall and handling of unsafe food under the MARD Circular 17/2021/TT-BNNPTNT. The food safety management authorities should guide them on applying the traceability regulations.

- Neither establishment has yet applied technological solutions for traceability based on QR and GS1 codes.

- The traceability exercise can only trace packaged and labelled products supplied to the supermarket system. Traceback and track forward can only be carried out in two steps: slaughtering, slicing, and packaging (i.e., Song Dat Company) and trading establishments (incl. BigC supermarket, MM Mega Market).

- They lack information to carry out effective trace-back and track-forward at the slaughtering and livestock production steps (suppliers/collectors).

- Standard operational processes for recalling and disposing of unsafe products have not been established and implemented.

The traceability team visited the **Nam Phong Food Processing** facility outside Ho Chi Minh City on December 6, 2022. We did not visit their farm or processing plant. The main findings are as follows:

- The facility purchased pork from Dong Hiep Pig Breeding Enterprise, under the same holding company as the Nam Phong facility. Other products, such as beef or shrimp, are purchased from various sources.

- There was a complete archive of traceability records of product suppliers and customers. However, traceability lookup is done manually on paper records according to the procedure outlined in the facility's ISO 22000:2018 document.

- There was no separate traceability and product recall procedure if food safety standards were unmet.

8.4 Cooperatives / Farms

The traceability team surveyed two cooperatives: **Chuc Son Safe Vegetable Cooperative** and **Bac Hong Cooperative**. These are the two primary vegetable production and supply establishments in Hanoi. Below are the findings:

- Both cooperatives have developed and implemented their quality control and traceability processes.

- Both cooperatives have been guided by the Hanoi DARD on the regulations on traceability and are subsidized (no cost) to use the food traceability software of Hanoi City (hn.check.net.vn). The Hanoi DARD issued the ID and password to access the software. The steps include using a user ID and password to log in to the hn.check.net.vn; generating a QR code for each product batch; updating information about the batch; printing out traceability labels, including product name, manufacturer's name, production date, expiry date, QR code. The traceability label is affixed on the product packaging at the Cooperative's primary processing facility. See the photo below for Bac Hong. The cooperatives can label according to GS1 standards if their customers request them to.

Figure 30 Images from Bac Hong packaging, labelling and usage of a digital traceability system

- In verifying how the traceability works, the team scanned several QR codes on various product traceability labels. The information showed on the smartphone includes information on the hn.check.net.vn: product name, product image, net weight; name and address of the Cooperative;

information and address where the product is distributed; information about the date of manufacture; instructions for use and preservation are printed on the access stamp.

- Chuc Son has 25 households with 60 members. Five years ago, they were involved in a traceability project with a donor but met with lots of constraints, especially at the smallholder compliance level.

- Chuc Son has 30 hectares, and 5 hectares are VietGAP certified. They trade 5-6 tons of produce every day. Thirty percent is sold to supermarkets, forty percent to collective kitchens and thirty percent to food service and convenience stores. Linkages with other cooperatives are very important due to seasonality.

- Chuc Son Safe Vegetable Cooperative was registered with GS1 Vietnam and assigned company prefix 8938523564 for their products and locations from 1/11/2018 to 31/10/2021. The Cooperative has applied to renew/their membership with GS1. However, the Cooperative does not yet know how to use the GS1 code for traceability for their products.

- Bac Hong has 42 farmers and trades about 3 tons per day or 100 tons per month. Thirty percent of farmers sell all their produce to the cooperative. The remaining seventy percent sell fifty to seventy percent to the cooperative and the remainder to collectors.

- Food safety is their #1 priority. They maintain a good reputation with formal retailers such as Lotte, BIG C, TOPS market and collective kitchens in hospitals and schools.

- The cooperative visits their farms every 2 to 3 days. Farmers take pictures of their crops and send them via Zalo.

- Bac Hong uses proprietary traceability software, but it is not integrated, and there is no traceability to the actual smallholder farms. It is possible, but there is a nominal cost of 300 dong to print labels per smallholder.

Figure 31 Example of Bac Hong labelling and GS1 membership

- Labelling contents comply with the regulations on goods labelling. However, the traceability information did not have the information down to the household-based farmer/member level.

- Both cooperatives face difficulties in implementing traceability down to the household-based farmer level due to farmers' poor habit of not keeping the farm book/farm diary updated on the

production process/or lack of skills in updating information in the electronic form (for Bac Hong Cooperative). The coop management at Chuc Son noted that smallholder manual records are either inconsistent or incorrect.

The traceability team visited **Tuan Ngoc Vegetable Production Cooperative** on December 5, 2022. The main findings are as follows:

- The cooperative consists of 8 members with a total farm area of 11,000 m2 with an output of 30 tons/per month. Vegetables are grown hydroponically, controlled for seed quality and nutrition, and have undergone measures to prevent and kill pests.

- Vegetables are tagged with identification and traceability cards for areas with the exact planting dates; the information on the cards includes planting dates, types of vegetables, and planting areas.

- Identification cards are also attached to each product during the stages of harvest and packaging, and information is noted in traceability records.

- For traceability, the establishment uses GS1 standards and QR codes attached to product labels. The information obtained when scanning the GS1 codes and QR codes includes the name of Tuan Ngoc Agriculture Cooperative and the name of the vegetable (not shown are the name of the cooperative farm member, the vegetable production batch code, and the date of vegetable cultivation which the Cooperative has documented in their physical records)

8.5 Kitchens and Caterers

The team went to various school and hospital kitchens and caterers to learn more about their supply chains and how their traceability systems functioned. The cooperatives play an important role as key suppliers to kitchens because they grow their vegetables, buy from a variety of other sources, and, in some cases, act as a single supplier to some schools, including purchasing meat, fish, poultry, rice, cooking oils etc. from school-approved sources.

Due to the potential risk of foodborne illness outbreaks, caterers play a critical role, and some cater to more than 100 kitchens daily. Some may be primary producers of specific vegetables while sourcing a wide range of F&V, meats, fish, poultry, and other products from various sources. Their supply chains are complicated because they buy, sort, wash, and prepare ingredients, cook meals, and deliver (in-house or as a service) to schools, industrial kitchens, and government offices. Traceability and recall practices and food safety handling have knowledge gaps in this critical food industry segment.

Our first stop was at a hospital, which provided the infrastructure and contracted out the sourcing and meal preparation to a single ISO-certified firm. The key findings for kitchens and caterers are as follows.

Department of Nutrition - Ha Dong General Hospital

- Ha Dong General Hospital has infrastructure facilities that **Truong Sinh Trading and Services Single-Member Liability Co.**, Ltd. can use to operate, process, and provide meals to the hospital's patients, patients' family members, and hospital staff and employees.

- Truong Sinh Trading has developed and issued regulations on food traceability according to the requirements of ISO 22000. However, the process has not been updated with procedures regarding the recall and disposal of unsafe food.

- Meals prepared by the kitchen are labelled with enough information in accordance with regulations on goods labels. However, they have not yet applied the product traceability apps, such as QR code/GS1 code. The company used barcodes on product labels at the time of the visit. However, when the team used the Zalo or QR app to scan, only information on the meal classification code, not traceability information, was shown. See photos.

Figure 32 Packaging and labelling of special meals at Ha Dong General Hospital

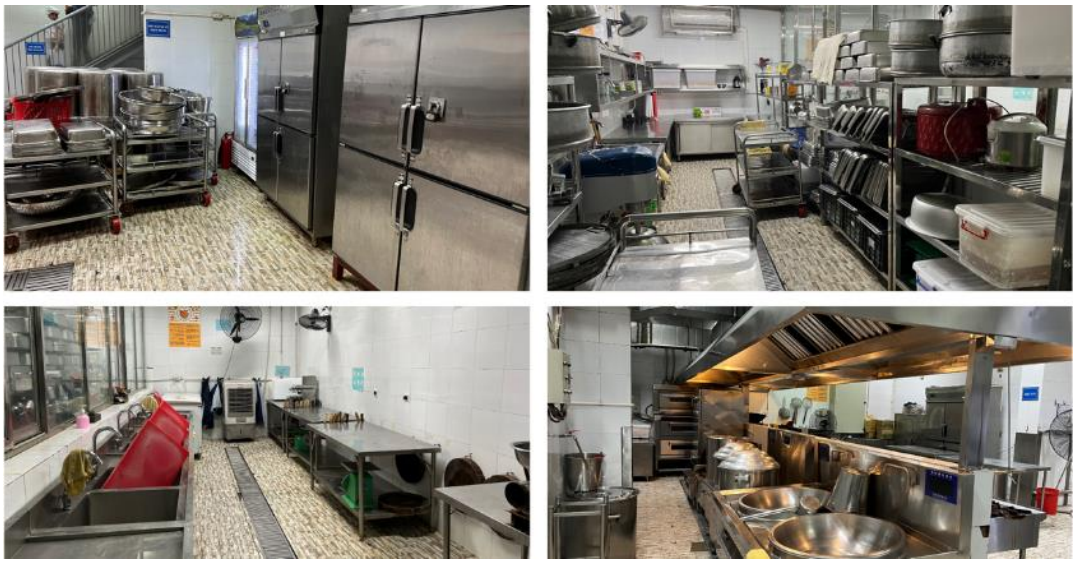
Hoa Hong Industrial Catering and Restaurant Co., Ltd. in Ho Chi Minh City.

- All employees are informed about traceability regulations. They have attended food safety training sessions.
- For the industrial catering section: complete daily records of raw material suppliers and customers. Traceability can be performed according to the procedure described in ISO 22000:2018 of the company.
- For the restaurant: they store paper records of information about the daily purchase of materials and information on the customers who hold large gatherings/events/parties at the restaurant for food safety reasons.

Marie Curie School - Hanoi

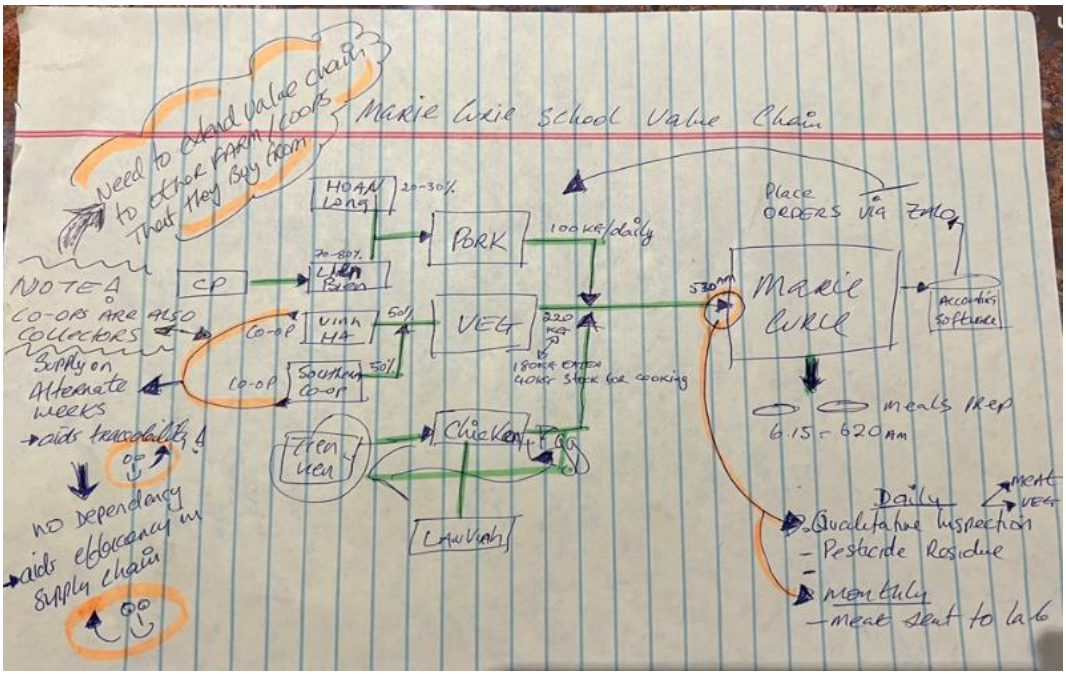
- Marie Curie has 5,500-6,000 students, employs 30 cooks and has not experienced a foodborne disease outbreak. They keep samples for 24 hours as per regulations.
- Traceability is made easier as they order different cuts of meat from suppliers and rotate suppliers weekly to ensure no dependency.
- Meat and fish are tested for food safety once per month, while vegetables and fruit are tested daily for pesticide residues

Figure 33 Kitchen images at Marie Curie school



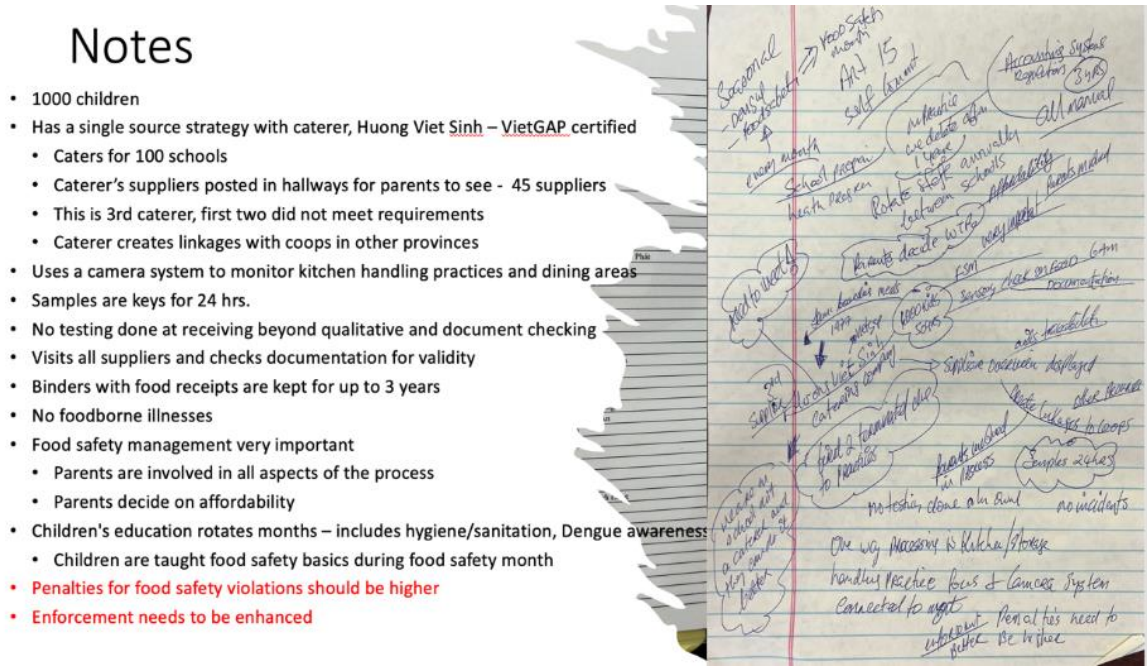
- The school places orders via Zalo and uses accounting software and another program to plan meals.
- Perceived risk is where some suppliers are collectors. See the value chain below.

Figure 34 Marie Curie value chain drafted in the workshop



Trường Tiểu học Phương Liên – public primary school in Hanoi on the 25th of November 2022.

Figure 35 Notes and comments from meeting with the school

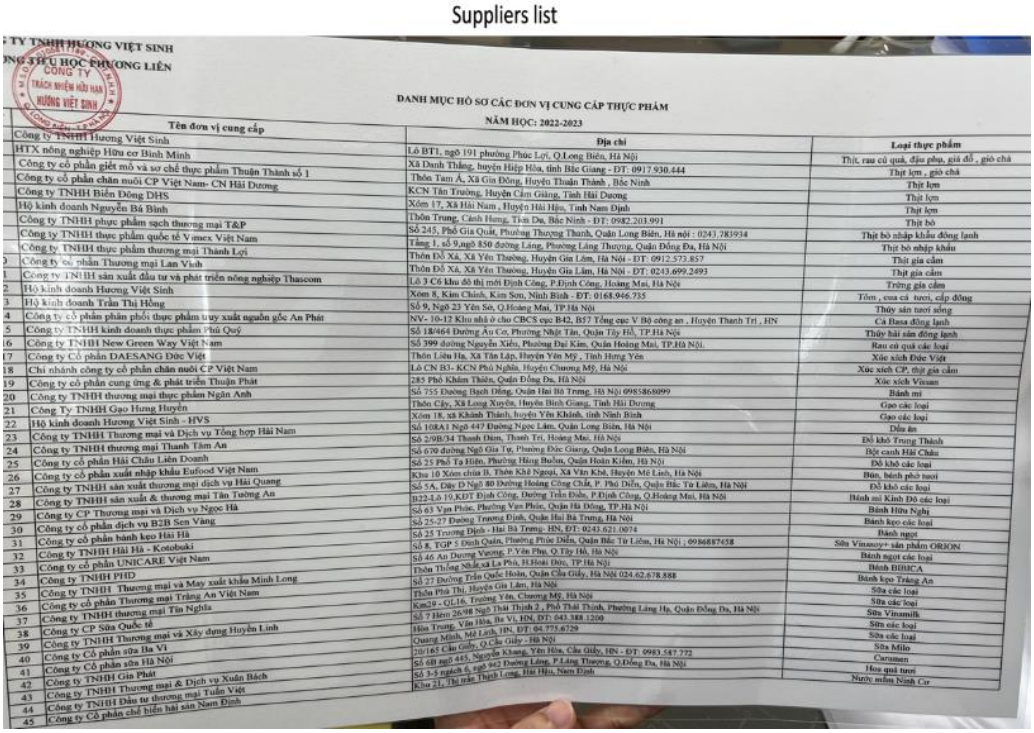


Notes

- 1000 children
- Has a single source strategy with caterer, Huong Viet Sinh – VietGAP certified
  - Caters for 100 schools
  - Caterer's suppliers posted in hallways for parents to see - 45 suppliers
  - This is 3rd caterer, first two did not meet requirements
  - Caterer creates linkages with coops in other provinces
- Uses a camera system to monitor kitchen handling practices and dining areas
- Samples are keys for 24 hrs.
- No testing done at receiving beyond qualitative and document checking
- Visits all suppliers and checks documentation for validity
- Binders with food receipts are kept for up to 3 years
- No foodborne illnesses
- Food safety management very important
  - Parents are involved in all aspects of the process
  - Parents decide on affordability
- Children's education rotates months – includes hygiene/sanitation, Dengue awareness
  - Children are taught food safety basics during food safety month
- Penalties for food safety violations should be higher
- Enforcement needs to be enhanced

- The school publishes a list of all suppliers on their noticeboard for parents to review.

Figure 36 List of suppliers posted on the school noticeboard



Suppliers list

TY TNHH HƯƠNG VIỆT SINH
NG 3 TIỂU HỌC PHƯƠNG LIÊN

DANH MỤC HỒ SƠ CÁC ĐƠN VỊ CUNG CẤP THỰC PHẨM
NĂM HỌC: 2022-2023

	Tên đơn vị cung cấp	Địa chỉ	Loại thực phẩm
	Công ty TNHH Hương Việt Sinh	Lô BT1, ngõ 191 phường Phúc Lợi, Q.Long Biên, Hà Nội	Thịt, rau củ quả, đậu phụ, giò đỗ , giò chả
	HTX nông nghiệp Hữu cơ Bình Minh	Xã Danh Thắng, huyện Hiệp Hòa, tỉnh Bắc Giang - ĐT: 0917.930.444	Thịt lợn , giò chả
	Công ty cổ phần giết mổ và sơ chế thực phẩm Thuận Thành số 1	Thôn Tam Á, Xã Gia Đông, Huyện Thuận Thành , Bắc Ninh	Thịt lợn
	Công ty cổ phần chăn nuôi CP Việt Nam- CN Hải Dương	KCN Tân Trường, Huyện Cẩm Giàng, Tỉnh Hải Dương	Thịt lợn
	Công ty TNHH Biển Đông DHS	Xóm 17, Xã Hải Nam , Huyện Hải Hậu, Tỉnh Nam Định	Thịt lợn
	Hộ kinh doanh Nguyễn Bá Bình	Thôn Trung, Cảnh Hưng, Tiên Du, Bắc Ninh - ĐT: 0982.203.991	Thịt bò
	Công ty TNHH phực phẩm sạch thương mại T&P	Số 245, Phố Gia Quất, Phường Thượng Thanh, Quận Long Biên, Hà nội : 0243.7819341	Thịt bò nhập khẩu đông lạnh
	Công ty TNHH thực phẩm quốc tế V-mex Việt Nam	Tầng 1, số 9,ngõ 850 đường Láng, Phường Láng Thượng, Quận Đống Đa, Hà Nội	Thịt bò nhập khẩu
	Công ty TNHH thực phẩm thương mại Thành Lợi	Thôn Đồ Xá, Xã Yên Thường, Huyện Gia Lâm, Hà Nội - ĐT: 0912.573.857	Thịt gia cầm
	Công ty cổ phần Thương mại Lan Vinh	Thôn Đồ Xá, Xã Yên Thường, Huyện Gia Lâm, Hà Nội - ĐT: 0243.699.2493	Thịt gia cầm
	Công ty TNHH sản xuất đầu tư và phát triển nông nghiệp Thascom	Lô 3 C6 khu đô thị mới Định Công, P.Định Công, Hoàng Mai, Hà Nội	Trứng gia cầm
	Hộ kinh doanh Hương Việt Sinh	Xóm 8, Kim Chính, Kim Sơn, Ninh Bình - ĐT: 0168.946.735	Tôm , cua cá tươi, cấp đông
	Hộ kinh doanh Trần Thị Hồng	Số 9, Ngõ 23 Yên Sở, Q.Hoàng Mai, TP.Hà Nội	Thủy sản tươi sống
	Công ty cổ phần phân phối thực phẩm tuy xuất nguồn gốc An Phát	NV- 10-12 Khu nhà ở cho CBCS cục B42, B57 Tổng cục V Bộ công an , Huyện Thanh Trì , HN	Cá Basa đông lạnh
	Công ty TNHH kinh doanh thực phẩm Phú Quý	Số 18/464 Đường Âu Cơ, Phường Nhật Tân, Quận Tây Hồ, TP.Hà Nội	Thủy hải sản đông lạnh
	Công ty TNHH New Green Way Việt Nam	Số 399 đường Nguyễn Xiển, Phường Đại Kim, Quận Hoàng Mai, TP.Hà Nội.	Rau củ quả các loại
	Công ty Cổ phần DAESANG Đức Việt	Thôn Liêu Hạ, Xã Tân Lập, Huyện Yên Mỹ , Tỉnh Hưng Yên	Xúc xích Đức Việt
	Chi nhánh công ty cổ phần chăn nuôi CP Việt Nam	Lô CN 8B- KCN Phú Nghĩa, Huyện Chương Mỹ, Hà Nội	Xúc xích CP, thịt gia cầm
	Công ty cổ phần cung ứng & phát triển Thuận Phát	285 Phố Khâm Thiên, Quận Đống Đa, Hà Nội	Xúc xích Vissan
	Công ty TNHH thương mại thực phẩm Ngân Anh	Số 755 Đường Bạch Đằng, Quận Hai Bà Trưng, Hà Nội 0985868999	Bánh mì
	Công Ty TNHH Gạo Hưng Huyên	Thôn Cây, Xã Long Xuyên, Huyện Bình Giang, Tỉnh Hải Dương	Gạo các loại
	Hộ kinh doanh Hương Việt Sinh - HVS	Xóm 18, xã Khánh Thành, huyện Yên Khánh, tỉnh Ninh Bình	Gạo các loại
	Công ty TNHH Thương mại và Dịch vụ Tổng hợp Hải Nam	Số 108A1 Ngõ 447 Đường Ngọc Lâm, Quận Long Biên, Hà Nội	Dầu ăn
	Công ty TNHH Thương mại Thanh Tâm An	Số 2/9B/34 Thanh Đàm, Thanh Trì, Hoàng Mai, Hà Nội	Đồ khô Trung Thành
	Công ty cổ phần Hải Châu Liên Doanh	Số 670 đường Ngô Gia Tự, Phường Đức Giang, Quận Long Biên, Hà Nội	Bột canh Hải Châu
	Công ty cổ phần xuất nhập khẩu Eufood Việt Nam	Số 25 Phố Tạ Hiện, Phường Hàng Buồm, Quận Hoàn Kiếm, Hà Nội	Đồ khô các loại
	Công ty cổ phần xuất khẩu thương mại dịch vụ Hải Quang	Khu 10 Xóm chùa B, Thôn Khê Ngoại, Xã Vân Khê, Huyện Mê Linh, Hà Nội	Bún, bánh phở tươi
	Công ty TNHH sản xuất thương mại dịch vụ Hải Quang	Số 5A, Dãy D Ngõ 80 Đường Hoàng Công Chất, P. Phú Diễn, Quận Bắc Từ Liêm, Hà Nội	Đồ khô các loại
	Công ty TNHH sản xuất & thương mại Tân Tường An	B22-Lô 19,KDT Định Công, Đường Trần Đăng, P.Định Công, Q.Hoàng Mai, Hà Nội	Bánh mì Kinh Đô các loại
	Công ty CP Thương mại và Dịch vụ Ngọc Hà	Số 63 Vạn Phúc, Phường Vạn Phúc, Quận Hà Đông, TP.Hà Nội	Bánh Hữu Nghị
	Công ty cổ phần dịch vụ B2B Sen Vàng	Số 25-27 Đường Trương Định, Quận Hai Bà Trưng, Hà Nội	Bánh kẹo các loại
	Công ty cổ phần bánh kẹo Hải Hà	Số 25 Trương Định - Hai Bà Trưng- HN, ĐT: 0243.621.0074	Bánh ngọt
	Công ty TNHH Hải Hà - Kotobuki	Số 8, TGP 5 Định Quán, Phường Phúc Diễn, Quận Bắc Từ Liêm, Hà Nội ; 0986887458	Sữa Vinamilk+ sản phẩm ORION
	Công ty cổ phần UNICARE Việt Nam	Số 46 An Dương Vương, P.Yên Phụ, Q.Tây Hồ, Hà Nội	Bánh ngọt các loại
	Công ty cổ phần PHD	Thôn Thống Nhất xã La Phù, H.Hoài Đức, TP.Hà Nội	Bánh BIBICA
	Công ty TNHH Thương mại và May xuất khẩu Minh Long	Số 27 Đường Trần Quốc Hoàn, Quận Cầu Giấy, Hà Nội 024.62.678.888	Bánh kẹo Tràng An
	Công ty TNHH thương mại Trăng An Việt Nam	Thôn Phù Thị, Huyện Gia Lâm, Hà Nội	Sữa các loại
	Công ty cổ phần Thương mại Tín Nghĩa	Km29 - QL16, Trường Yên, Chương Mỹ, Hà Nội	Sữa các loại
	Công ty TNHH thương mại Tín Nghĩa	Số 7 Hẻm 26/98 Ngõ Thái Thịnh 2 , Phố Thái Thịnh, Phường Láng Hạ, Quận Đống Đa, Hà Nội	Sữa các loại
	Công ty CP Sữa Quốc tế	Hòa Trung, Yên Hòa, Ba Vì, HN, ĐT: 043.388.1200	Sữa các loại
	Công ty TNHH Thương mại và Xây dựng Huyền Linh	Quang Minh, Mê Linh, HN. ĐT: 04.775.6729	Sữa các loại
	Công ty TNHH Thương mại & Dịch vụ Xuân Bách	20/165 Cầu Giấy, Q.Cầu Giấy - Hà Nội	Sữa Milo
	Công ty Cổ phần sữa Hà Nội	Số 6B ngõ 465, Nguyễn Khang, Yên Hòa, Cầu Giấy, HN - ĐT: 0983.587 772	Ovaltine
	Công ty Cổ phần Gia Phát	Số 3-5 ngách 6, ngõ 942 Đường Láng, P.Láng Thượng, Q.Đống Đa, Hà Nội	Hoa quả tươi
	Công ty TNHH Thương mại & Dịch vụ Tuấn Việt	Số 3-5 ngách 6, ngõ 942 Đường Láng, Hải Hậu, Nam Định	Nước mắm Ninh Cư
	Công ty TNHH Đầu tư thương mại Tuấn Việt	Khu 21, Thị trấn Thịnh Long, Hải Hậu, Nam Định	
	Công ty Cổ phần chế biến hải sản Nam Định		

8.6 Information Technology

Because of its high Internet and mobile penetration rates, Vietnam's rapidly expanding information technology (IT) infrastructure can support digital traceability systems in large and small cities. Nonetheless, accessing the Internet and mobile phone services is difficult in rural and mountainous areas.

- Currently, there are numerous competent technology firms in Vietnam providing solutions for traceability that can apply GS1 barcodes, with the majority applying proprietary QR codes for traceability. Technologies used include in-house developed solutions, blockchain (e.g., Traceverified, TE-FOOD, Akachain, Bytesoft, Freshdi, CMC and others), IoT and big data (e.g., Nextfarm, Tracefarm, Beetech, AGRI-SCM), anti-counterfeiting by scratch coating (e.g., checkvn, icheck, vntrace).

- The Ministry of Information and Communications proposes blockchain technology. Blockchain technology improves the transparency of the agricultural supply chain and helps build consumer trust. However, while blockchain technology promises many potential benefits as an enabler of food safety, it faces numerous challenges, as outlined by Keogh et al. (2022)[53].

- The application of blockchain technology must deal with operational challenges such as cost, privacy, energy, time, and other resource consumption to maintain the blockchain system. As the blockchain becomes more complex over time, the challenges become more complicated when more data and nodes join the system. Blockchain requires the collaboration of many participants, such as government organizations, businesses, coordinating agencies, and partners, to implement their blockchain nodes in the traceability blockchain ecosystem. It is also necessary to determine the international information-sharing standards for better communication. Implementing a blockchain requires professional support from the very first stages when designing and building the system.. See Figure 6 for potentials and challenges.

  These difficulties and challenges are similar to other traceability technologies. The high cost is especially unsuitable for small, low-cost products such as most food in informal markets. Moreover, these advanced technologies are not regulated, and some blockchain platforms may have an associated cryptocurrency. However, barcode technology, including QR codes, is well-established, supported and trusted by businesses because of its affordability and reliability.

[53] Keogh et al. (2022) Blockchain: an enabler for safe food in global supply networks

9 Summary Findings

Vietnam has sufficient normative documents to regulate and enforce traceability and recall in the context of food safety and consumer protection. Our research (and prior research) indicates that regulatory staff training, tools (inspection guidelines, templates, etc.) and human resources for governance and enforcement are significantly lacking. Furthermore, despite numerous TCVNs for various aspects of traceability for signature and high-risk products, TCVNs are voluntary and non-enforceable. Considerations should be given to creating specific enforceable regulations for signature or high-risk foods, similar to other jurisdictions mentioned earlier in this report.

Vietnam has made some progress in advancing traceability in the domestic market. This was particularly evident in organized retail during meetings and site visits. In particular, Ho Chi Minh City has advanced traceability in the pork value chain with GS1 barcodes and QR codes applied to retail products. This is an excellent example of a competent authority developing and successfully implementing a traceability framework and operational model that other jurisdictions could consider replicating.

According to our findings and the World Bank report referenced earlier, informal market supply chains do not perform traceability due to operational costs, technical constraints, and a lack of demand for traceability. Select pilots and capacity building will help the supply side better understand why traceability is important for food safety and consumer trust. Further, we identified a very good practice in a Ho Chi Minh-based traditional market that had colour-coded signage above each stall, which acts to provide consumers with vendor identification, contact details, and product origin (in several cases). This is foundational information needed for traceability and may serve as a model for other jurisdictions to consider.

Traceability awareness and its critical role in driving industry supply chain efficiencies and protecting consumers' health and safety are observed in our research (and prior research) as poor on both the demand side (consumers, food service) and supply side (suppliers, cooperatives and collectors). Common feedback and research reflect the traditional frugality of the Vietnamese culture and a consumer focus that is primarily based on product freshness and price. Traceability is considered an unnecessary additional cost despite some research indicating consumers' willingness to pay more for traceable products. Raising awareness of consumers, smallholders, food business operators, and regulators about traceability, recall and food safety is critical in improving transparency and trust in the food supply chain. However, capacity-building training sessions often have a fixed time and location that may not be suitable for some participants, for example, smallholders (especially women with both farming and household duties), informal market sellers, and students. In addition, participating organizations often participate with very few staff. Therefore, online training can be a good solution for different stakeholders and facilitates intervention scalability - participants can join anytime, anywhere, with a flexible choice of courses. An example of modular e-traceability training for inspectors from the UK Food Safety Authority is also included in Appendix 1.

Despite the existence of twenty TCVNs with very detailed guidance on product identification, labelling, traceability and recall for fresh fruit and vegetables, meats and fish, there is an observed lack of awareness and implementation of these TCVNs outside of the GS1 member base. More concerning, as of March 2023, MARD did not have a working relationship with MOST/STAMEQ/NBC, who have state-wide responsibility for traceability and the national traceability portal.

Supply chain technology is not a significant concern in Vietnam, and many competent technology solution providers exist. The core issue is the lack of adoption of common data standards, such as GS1, which limits their ability to interoperate and share information with other solutions along the value chain.

10 Recommendations

Based on the extensive research and summary findings, the traceability team makes the following recommendations:

10.1 General Recommendations

- Develop a National Traceability Framework and Implementation Plan in support of Decision 100.
- Consider the replication of the HCMC pork chain traceability in other jurisdictions
- Consider the replication of the traditional market colour-coded signage observed in HCMC
- Revamp the VietGAP certification program and create one unified logo and a portal where consumers and domestic/international businesses can verify the credentials.

10.2 For State-management agencies

MOH and MARD:

- Research and develop guidelines for the inspection/audit/assessment of food traceability under the issued Circulars. This is intended to improve the efficiency and effectiveness of the inspection process by competent authorities and the handling of traceability-related violations.
- Research and develop an online training and resource portal on food safety and traceability for inspectors and food business operators. Appendix 1 shows an example of the Canadian government website with resources such as a Traceability Handbook for Industry, Traceability Fact Sheet and other resources.
- Direct relevant specialized agencies to review the current TCVN guidelines on traceability for fresh fruit, fresh meat and packaged foods.
- Research and put in place the policies to utilize the capacity of organized retail to aid in the promotion of traceability and food safety compliance.

MOST

- Promote the VNTP portal through capacity-building workshops with competent authorities, food business operators, retailers and technology solution providers.
- Develop, issue and apply national standards for connecting electronic data systems for cross-border traceability. This aligns with a previous agreement that Canada and Vietnam approved at the Asia Pacific Economic Cooperation (APEC) forum on applying Global Data Standards[54] to facilitate international trade.
- Create and promote a Traceability Implementation Framework – this should be created to guide businesses and technology solution providers on how to apply interoperable industry standards in the domestic and export markets.

[54] https://www.apec.org/docs/default-source/publications/2020/3/apec-guidelines-and-best-practices-for-the-adoption-of-global-data-standards/220_cti_apec-guidelines-and-best-practice-for-the-adoption-of-gds.pdf?sfvrsn=fb304fc6_1

Local authorities (PPC, DARD, DOH, DOIT and affiliated agencies; DPC, District DARD and Economics)

- Enhancing guidance and training on knowledge and regulations on traceability, recall and handling of unsafe food for FBOs, particularly at the primary production and wholesale market. Diversify the forms of online and offline training.

- Taking measures to manage wholesale and retail markets to improve compliance with the requirements on information for traceability, including shop signage, stalls, and outlets; information on traders; information on the origin of the batch of products on sale; requiring traders to keep notebooks for the process of importing and trading products at the market.

- Providing training for the food safety and traceability enforcement officers to improve their knowledge and expertise in the examination and inspection of traceability.

- Strengthening the inspection and handling of violations on traceability.

10.3 Food Business Operators for fresh Produce and Pork value chains surveyed in Hanoi and HCMC

- Allocate adequate resources and personnel for traceability training and knowledge on applying concepts and standards within a product traceability system along the value chain.

- Improve templates for bookkeeping to provide necessary information for traceability. Ensure the effectiveness and efficiency of the traceability system.

- For FBOs with mature supply chain and digital traceability solutions, practice a mock recall annually.

10.4 Traceability solution providers

- There is a need for guidelines for traceability service/solution providers on the development and operation of traceability systems. It is recommended that solution providers work with NBC/GS1 for guidance on applying standards.

- There is a need to standardize data on traceability among solution providers, mining shared digitized data for traceability, and speed up the process of development and interoperability with the National Product Traceability Portal (VNTP)

10.5 Social organizations (consumer rights protection, Industry Associations, NGOs)

- Strengthen engagement with consumers, food business operators and organized retail to continue capacity building on the critical importance of food traceability and recall effectiveness.

- Allocate resources to communicate with consumers to ensure their concerns are heard, and dispute resolution processes and/or supplier feedback mechanisms are in place for unsafe or recalled foods.

11 Next Steps for SAFEGRO

It is vital to raise awareness of traceability's value and critical nature on both the supply side (smallholders/cooperatives) and the demand side (business buyers/consumers).

Traceability and pilot demonstration

Many solution providers in the Vietnamese market offer traceability software and solutions, but their focus is primarily on internal traceability. Most solutions lack the connectivity, information sharing, and interoperability required to ensure end-to-end traceability throughout the supply chain. As a result, traceability, data integrity, and visibility cannot be guaranteed. It is necessary to encourage solution providers that meet the traceability requirements in regulations to ensure their technologies can connect and interact with other solutions and services, including the VNTP. Furthermore, supply chain solutions must ensure international connectivity. Building standards-based solutions while adhering to national traceability regulations is a prerequisite for improving the supply chain, enhancing consumer safety, and improving transparency and trust.

Workshops, seminars and training

It is recommended to organize training courses, seminars or workshops to introduce supply chain standards and how to apply them in digital solutions. The workshops and training courses can be organized for each specific stakeholder: training for state management agencies, professional and technical staff, farmers, manufacturers and others who participate in the industry supply chain.

The online and face-to-face training courses should be organized in North, Central and South regions. This is an opportunity to help small and medium enterprises, and manufacturers gain knowledge and understand the regulations and laws of Vietnam and other countries worldwide.

After organizing the training courses, surveys should be conducted to evaluate and analyze the results. From there, it is possible to make development requirements for solutions, services and e-learning applications.

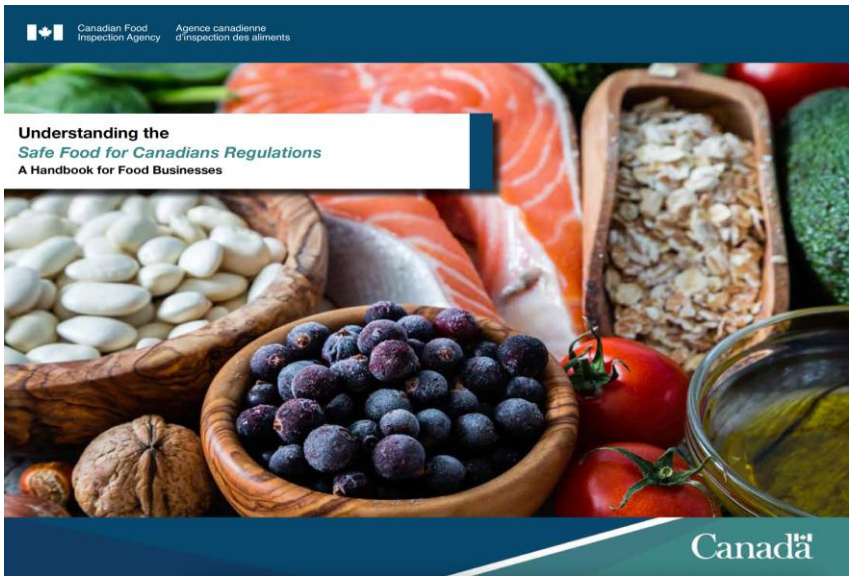
Table 3 provides a preliminary overview of capacity building and other interventions by stakeholders.

Table 3 Overview of Interventions

Stakeholder	Traceability Awareness	VNTP Awareness	Interoperability Awareness	Traceability Training	Traceability Plan	Mock Recall	Traceability Pilot	e-Diary Pilot	QR-ID on Certification
Smallholder									
Cooperatives									
Collectors									
Traders									
Retailer									
Caterers									
Kitchens									
Solution Providers									
Consumers									
Regulators									
Certification Bodies									
Laboratories									

12 Appendix 1: Examples of Regulatory Best Practices

Regulatory Best Practice:
Traceability Handbook for Food Businesses



Regulatory Best Practice:
Traceability Fact Sheet

Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

Fact Sheet: Traceability
Safe Food for Canadians Regulations

Traceability is the ability to track the movement of a food or a food commodity, one step back and one step forward.

Under the Safe Food for Canadians Regulations (SFCR), traceability requirements apply to most food businesses that:

- import food
- export food
- distribute or send food products across provincial or territorial borders
- manufacture, process, treat, preserve, grade, store, package or label food to be exported or sent across provincial or territorial borders
- grow and harvest fresh fruits or vegetables to be exported or sent across provincial or territorial borders
- slaughter food animals from which meat products are derived, where the meat product is exported or sent across provincial or territorial borders
- store and handle edible meat products in their imported condition for inspection by the Canadian Food Inspection Agency (CFIA)
- sell food to consumers at retail, which would need to be traced one step back but not forward to the consumer

The traceability requirements do not apply to restaurants and other similar enterprises.

Find out what traceability requirements apply to you and when by using the traceability interactive tool. It only takes 5 minutes.

How does it work?

The traceability documents must:

- **identify the food:** the common name of the food, the name and address of the person who manufactured, prepared, produced, stored, packaged or labelled the food, and a lot code[1] or other unique identifier[2] to trace the food
- **trace the food one step back** to the person who provided you with the food, including the date on which the food was provided to you
- **trace the food one step forward** to the person to whom you provided the food, including the date on which you provided the food
- if applicable, identify and trace back the ingredients you use to make the food, including the date on which they were provided to you

Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

- if applicable, identify and trace back the food animals you slaughter

Clear and readable records are to be maintained for two years, be accessible in Canada, and provided to the CFIA upon request. Where electronic records are used, they need to be provided in a single file and in a format that can easily be opened and used in standard commercial software.

Why it matters

While many businesses in Canada have simple traceability records in place, others do not. This can impact the effectiveness and timeliness of food safety investigations and recalls.

Businesses that trace the source of each food supplied to them (one step back) and its next destination (one step forward) can access timely and precise information as needed. This can significantly reduce the time it takes businesses to remove unsafe food from the market. This better protects Canadians and increases confidence in Canada's food safety system.

Learn more at www.inspection.gc.ca/safefood.

You may also be interested in:

- Video: Get Ready for the Safe Food for Canadians Regulations
- Traceability interactive tool
- Regulatory requirements: Traceability
- Understanding the Safe Food for Canadians Regulations: A handbook for food businesses
- Questions and Answers: Traceability
- Getting started: Toolkit for businesses

[1] **lot code** refers to a code that can be used to identify a lot that was manufactured, prepared, produced, stored, graded, packaged or labeled, under the same conditions. A lot code can be numeric, alphabetic or alphanumeric.

[2] **unique identifier** refers to a code that can be used to identify a defined quantity of food. This may include a lot code, purchase order number, or a bill of lading number.

Regulatory Best Practice: Traceability Interactive Tool


Government of Canada / Gouvernement du Canada

Home > Canadian Food Inspection Agency > Getting started: Toolkit for food businesses

Traceability interactive tool - Safe Food for Canadians Regulations

English

Progress 17%

Note: For optimal use of the functionalities of this tool, we recommend that you use Firefox or Google Chrome. If you are using Internet Explorer or another web browser, we recommend that you refer to the SFCR: Glossary of key terms - (Opens in a new window) to view the applicable definitions.

Some parts of your business may have traceability requirements, while others may not. Find out whether you need to prepare and keep traceability records, and what type of information you require by answering a few simple questions. It only takes about 5 minutes. The specific sections of the Safe Food for Canadians Regulations (SFCR) that outline the requirements are indicated where applicable.

General exemptions from the Safe Food for Canadians Regulations are:

- food for personal use, when the food is not intended for commercial use, and
  - the quantity of food is equal to or under the maximum quantity limits, found in the document "Maximum Quantity Limits for Personal Use Exemption - (Opens in a new window)," and
  - the food is imported, exported, sent or conveyed from one province to another by an individual other than in the course of business; or
  - the food is imported or exported as part of the personal effects of an immigrant or emigrant
- food that is carried on any conveyance that is intended for the crew or passengers
- food that is intended and used for analysis, evaluation, research, or a trade show provided that the food is part of a shipment that weighs 100 kg or less or, in the case of eggs, is part of a shipment of five or fewer cases
- food that is not intended or sold for human consumption
- food that is imported from the United States onto the Akwesasne Reserve by a permanent resident of the Reserve for their use
- food that is imported in bond (in transit) for use by crew or passengers of a cruise ship or military ship in Canada
- food that is traded between federal penitentiaries
- transporting a food commodity, if that is the sole activity of a person

[SFCR: 20(1); 21; 23(1), (a)-(c), (d)(i) and (e)]


Government of Canada / Gouvernement du Canada

Home > Canadian Food Inspection Agency > Getting started: Toolkit for food businesses

Traceability interactive tool - Safe Food for Canadians Regulations

English

Progress 35%

Select all the activities that apply to you. More than one activity may apply.

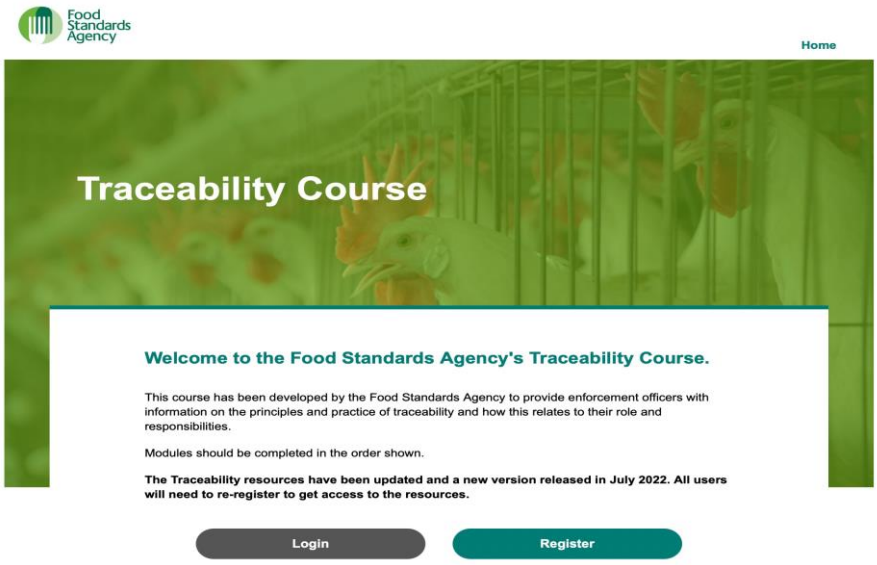
Activities related to the trade of food

- You send or convey from one province to another
- You import
- You export

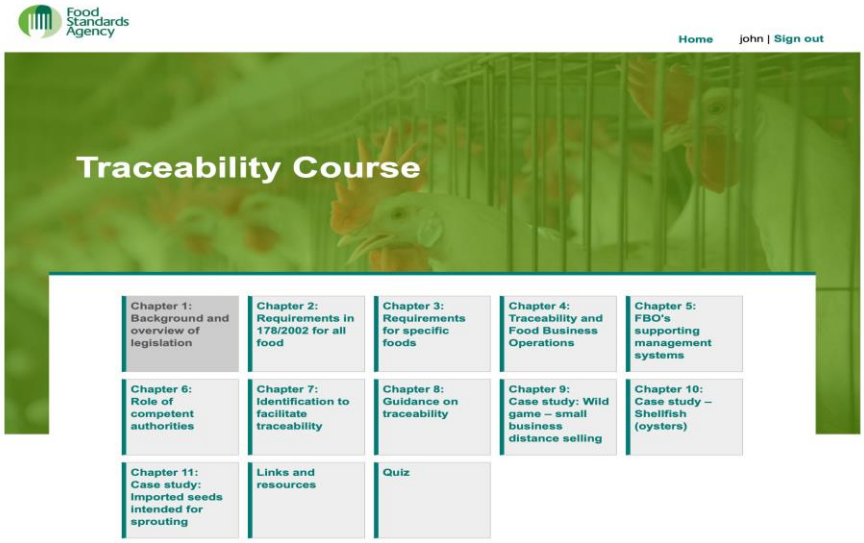
Other activities

- You have a licence to slaughter food animals
- You have a licence to manufacture, process, treat, preserve, grade, store, package or label food
- You have a licence to store and handle an edible meat product in its imported condition for inspection by the Canadian Food Inspection Agency (CFIA)
- You grow or harvest fresh fruits or vegetables for export, or to be sent or conveyed from one province to another
- You are a primary producer of eggs, fish, raw honey, maple sap, raw milk or unprocessed food set out in Schedule I for export or to be sent or conveyed from one province to another
- You sell food to consumers at retail other than at a restaurant or other similar enterprise. Examples of retail include supermarkets, grocery stores, bakeries and butcheries.

Regulatory Best Practice: Online Traceability Training for Inspectors



Regulatory Best Practice:
Online Traceability Training for Inspectors



13 Appendix 2: List of Traceability Laws, Directives, Circulars and TCVNs

#	Name
	Laws
01	Law 05/2007/QH12: Law on Quality of Products and Goods
02	Law 55/2010/QH12: Law on Food Safety
03	Law 31/2018/QH14: Law on Cultivation
04	Law 32/2018/QH14: Law on Livestock
05	Law 18/2017/QH14: Law on Fisheries
06	Law 79/2015/QH13: Law on Animal Health
	Decrees
01	GoV Decree 15/2018/ND-CP dated 2/2/2018 regarding detailed regulations for the implementation of a number of articles of the Law on Food Safety
02	GoV Decree 74/2018/ND-CP dated 15/5/2018 regarding revision to a number of articles of GoV Decree 132/2008/ND-CP dated 31/12/2008 regarding detailed regulations for the implementation of a number of articles of the Law on Quality of Products and Goods
03	GoV Decree 13/2022/ND-CP dated 21/1/2022 regarding revision of GoV Decree 132/2008/ND-CP and Decree 74/2018/ND-CP regarding detailed regulations for the implementation of a number of articles of the Law on Quality of Products and Goods; and GoV Decree 86/2012/ND-CP providing implementing guideline for the Law on Measurement
04	GoV Decree 109/2018/ND-CP dated 29/8/2018 regarding organic agriculture
05	GoV Decree 109/2018/ND-CP dated 29/12/2018 regarding detailed regulations for a number of articles regarding plant varieties and cultivation under the Law on Cultivation
06	GoV Decree 26/2019/ND-CP dated 08/3/2019 regarding detailed regulations for a number of articles and implementation arrangement for the Law on Fisheries
07	GoV Decree 27/2021/ND-CP dated 25/3/2021 regarding management of forestry plant varieties
08	GoV Decree 119/2017/ND-CP dated 1/11//2017 regarding sanctioning of administrative violations in the field of standard, measurement and quality
09	GoV Decree 126/2021/ND-CP dated 30/12/2021 regarding revision to a number of articles of the GoV Decrees on sanctioning of administrative violations in the field of industrial property,

	standard, measurement and quality of products and goods; scientific and technological activities, technology transfer; atomic energy
10	GoV Decree 115/2018/ND-CP dated 4/9/2018 regarding sanctioning of administrative violations on food safety
11	GoV Decree 124/2021/ND-CP dated 28/12/2021 regarding revision of a number of articles of the GoV Decree 115/2018/ND-CP dated 4/9/2018 regarding sanctioning of administrative violations on food safety, and the GoV Decree 117/2020/ND-CP dated 28/9/2020 regarding sanctioning of administrative violations in the field of health
	Prime Minister's Decisions
01	PM Decision 100/QD-TTg dated 19/1/2019 regarding granting approval to the Proposal on implementation, application and management of traceability system
	Circulars
01	Circular 23/2018/TT-BYT dated 14/9/2018 regarding regulations on recall and handling of unsafe food under the management of the Ministry of Health
02	Circular 25/2019/TT-BYT dated 30/8/2018 regarding regulations on traceability of food products under the management of the Ministry of Health
03	Circular 17/2021/TT-BNNPTNT dated 20/12/2021 regarding regulations on traceability, recall and handling of unsafe food under the management of the MARD

2 Danh mục TCVN về truy xuất nguồn gốc			List of Vietnam National Standards on Traceability	
No.	**Standard**	**Name of Standard in Vietnamese**	**Official Name of Standard in English (1)**	**Alternative Translation in English**
1	TCVN 22005:2008	Xác định nguồn gốc trong chuỗi thực phẩm và thức ăn chăn nuôi. Nguyên tắc chung và yêu cầu cơ bản đối với việc thiết kế và thực hiện hệ thống	Traceability in the feed and food chain – General principles and basic requirement for system design and implementation	Traceability in the feed and food chain. General principles and basic requirements for system design and implementation.
2	TCVN 9988:2013	Xác định nguồn gốc sản phẩm cá có vây - Quy định về thông tin cần ghi lại trong	Traceability of finfish products. Specification on the information to be	Traceability of finfish products - Specifications on the information to be

		chuỗi phân phối cá đánh bắt	recorded in captured finfish distribution chains	recorded in the distribution chains of capture fisheries (2)
3	TCVN 9989:2013	Xác định nguồn gốc sản phẩm cá có vây – Quy định về thông tin cần ghi lại trong chuỗi phân phối cá nuôi;	Traceability of finfish products. Specification on the information to be recorded in farmed finfish distribution chains	Traceability of finfish products – Regulations on the information to be recorded in the distribution chains of culture fisheries (2)
4	TCVN 12455:2018	Truy xuất nguồn gốc các sản phẩm động vật giáp xác – Quy định về thông tin cần ghi lại trong chuỗi phân phối động vật giáp xác nuôi	Traceability of crustacean products – Specifications on the information to be recorded in farmed crustacean distribution chains	Traceability of crustacean products – Regulations on the information to be recorded in the distribution chains of farmed crustaceans
5	TCVN 12456:2018	Truy xuất nguồn gốc các sản phẩm động vật giáp xác – Quy định về thông tin cần ghi lại trong chuỗi phân phối động vật giáp xác đánh bắt	Traceability of crustacean products – Specifications on the information to be recorded in captured crustacean distribution chains	Traceability of Crustacean Products – Regulations on the information to be recorded in the distribution chains of captured crustaceans
6	TCVN 12457:2018	Truy xuất nguồn gốc các sản phẩm nhuyễn thể – Quy định về thông tin cần ghi lại trong chuỗi phân phối nhuyễn thể nuôi	Traceability of molluscan products – Specifications on the information to be recorded in farmed molluscan distribution chains	Traceability of Molluscan Products – Regulations on the information to be recorded in the distribution chains of farmed molluscs
7	TCVN 12458:2018	Truy xuất nguồn gốc các sản phẩm nhuyễn thể – Quy định về thông tin cần ghi lại trong chuỗi phân phối nhuyễn thể đánh bắt	Traceability of molluscan products – Specifications on the information to be recorded in captured molluscan distribution chains	Traceability of Molluscan Products – Regulations on the information to be recorded in the distribution chain of captured molluscs
8	TCVN 12851:2019	Truy xuất nguồn gốc - Yêu cầu đối với tổ chức đánh giá và	Traceability - Requirements for bodies providing	Traceability - Requirements for bodies

		chứng nhận hệ thống truy xuất nguồn gốc	audit and certification of traceability systems	that audit and certify traceability systems
9	TCVN 12850:2019	Truy xuất nguồn gốc – Yêu cầu chung đối với hệ thống truy xuất nguồn gốc	Traceability – General requirements for traceability systems	Traceability – General requirements for a traceability system
10	TCVN 12827:2019	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng rau quả tươi	Traceability – Requirements for supply chain of fresh fruits and vegetables	Traceability – Requirements for fresh fruits and vegetables supply chains
11	TCVN 13166-1:2020	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng thịt gia súc và gia cầm – Phần 1: Yêu cầu chung	Traceability – Requirements for supply chain of meat and poultry – Part 1: General requirements	Traceability – Requirements for the meat and poultry supply chains – Part 1: General requirements
12	TCVN 13166-2:2020	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng thịt gia súc và gia cầm – Phần 2: Thịt trâu và thịt bò	Traceability – Requirements for supply chain of meat and poultry – Part 2: Buffalo meat and beef	Traceability – Requirements for livestock and poultry meat supply chains – Part 2: Buffalo and beef meat
13	TCVN 13166-3:2020	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng thịt gia súc và gia cầm – Phần 3: Thịt cừu	Traceability – Requirements for supply chain of meat and poultry – Part 3: Lamb and sheep meat	Traceability – Requirements for Livestock and Poultry Meat Supply Chains – Part 3: Sheep meat
14	TCVN 13166-4:2020	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng thịt gia súc và gia cầm – Phần 4: Thịt lợn	Traceability – Requirements for supply chain of meat and poultry – Part 4: Pork	Traceability – Requirements for Livestock and Poultry Meat Supply Chains – Part 4: Pork
15	TCVN 13166-5:2020	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng thịt gia súc và gia cầm – Phần 5: Thịt gia cầm	Traceability – Requirements for supply chain of meat and poultry – Part 5: Poultry	Traceability – Requirements for livestock and poultry meat supply chains – Part 5: Poultry

16	TCVN 13167:2020	Truy xuất nguồn gốc – Các tiêu chí đánh giá đối với hệ thống truy xuất nguồn gốc thực phẩm	Traceability – Compliance criteria for food traceability system	Traceability – Evaluation criteria for food traceability systems
17	TCVN 13258: 2020	Truy xuất nguồn gốc – Yêu cầu đối với chuỗi cung ứng thuốc hóa dược	Traceability – Requirements for supply chain of pharmacochemical medicine	Traceability – Requirements for the pharmaceutical drug supply chains
18	TCVN 13142-1:2020	Cacao được sản xuất bền vững và có thể truy xuất nguồn gốc – Phần 1: Yêu cầu đối với hệ thống quản lý sản xuất cacao bền vững	Sustainable and traceable cocoa – Part 1: Requirements for cocoa sustainability management systems	Sustainable and Traceable Cocoa – Part 1: Requirements for a sustainable cocoa production management system
	TCVN 13142-2:2020	Cacao được sản xuất bền vững và có thể truy xuất nguồn gốc – Phần 2: Yêu cầu đối với kết quả thực hiện (về các khía cạnh kinh tế, xã hội và môi trường)	Sustainable and traceable cocoa – Part 2: Requirements for performance (related to economic, social, and environmental aspects)	Sustainable and Traceable Cocoa – Part 2: Performance requirements (economic, social and environmental aspects)
	TCVN 13142-3:2020	Cacao được sản xuất bền vững và có thể truy xuất nguồn gốc – Phần 3: Yêu cầu về truy xuất nguồn gốc	Sustainable and traceable cocoa – Part 3: Requirements for traceability	Sustainable and Traceable Cocoa – Part 3: Traceability requirements
	TCVN 13142-4:2020	Cacao được sản xuất bền vững và có thể truy xuất nguồn gốc – Yêu cầu đối với các chương trình chứng nhận	Sustainable and traceable cocoa – Part 4: Requirements for certification schemes	Sustainable and Traceable Cocoa – Requirements for certification/accreditation schemes
19	TCVN 13274:2020	Truy xuất nguồn gốc – Hướng dẫn định dạng các mã dùng cho truy vết	Traceability – Guide for formatting tracing codes	Traceability – Guidelines for tracing codes format
20	TCVN 13275:2020	Truy xuất nguồn gốc – Định dạng vật mang dữ liệu	Traceability – The format of data carriers	Traceability – Format for the data carrier/bearer

14 Appendix 3: List of the establishments visited

Hanoi Mission

Working Sessions

ORGANIZATION	FUNCTION
Hanoi City	VFA
Chúc Sơn	Cooperative
Bắc Hồng	Cooperative
Hoàng Long	Cooperative
Song Đạt	Slaughterhouse & pork processor
Hoang Long	Slaughterhouse & pork processor
Chợ Đền Lừ	Wholesale wet market
Chợ Minh Khai	Wholesale wet market
Aeon Hà Đông	National Retailer
Aeon Long Biên	National Retailer
MM Thăng Long	National Retailer
Winconmerce	National Retailer
Bệnh viện đa khoa	Hospital Kitchen in Hà Đông
DaviCorp	Ingredient supplier to school kitchens
Huong Viet Sinh	Farmer/collector/caterer: school/gov kitchens
Marie Curie	Private school kitchen
Trường Tiểu học Phương Liên	Public school kitchen
Trường Mầm Non Nhân Chính	Public school kitchen
TRUÜNG THCS BA VI	Public school kitchen

HCMC Mission

Working Sessions

ORGANIZATION	FUNCTION
Ho Chi Minh City	Food Safety Management Authority
Ho Chi Minh City	Consumer protection association
Tuan Ngoc	Cooperative
Dong Hiep	Pig production enterprise
Nam Phong	Food processing establishment
Binh Dien	Wholesale wet market
Thu Duc (Aug)	Wholesale wet market (with Mdm Son)
Pham Van Hai	Retail wet market
Tu Anh	Caterer for industrial and school kitchens
MegaMarket HQ	National wholesaler
Hoa Hong	Government-owned hotel/restaurant kitchen
Bach hoa Xanh (Aug)	Retailer/e-commerce (with Mdm Son)

Note
Met with CEO of Mega Market who is ex-Carrefour and will open his business operations to SAFEGRO

Met CEO of TOPS Market in-store, formal meeting to be planned. He is ex-WalMart USA executive and very open to working with SAFEGRO