PROTOTYPING A TRACEABILITY SYSTEM FOR COFFEE VALUE CHAIN: A CASE STUDY OF LOCAL FARMERS IN PANGKHON, CHIANG RAI

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THIS THESIS IS A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN INFORMATION TECHNOLOGY

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ABSTRACT

The coffee industry plays a crucial role in the global agricultural sector, and the demand for traceability and value-added products has increased. This research focuses on prototyping a traceability system for the coffee value chain in Pangkhon, Chiang Rai, to improve transparency, enhance quality, support sustainability, and add value to the coffee produced in this region. The research methodology consists of data collection, design and prototypes, and prototype evaluation. In the data collection phase, information is gathered on objectives, regulatory requirements, products/ingredients, position in the food chain, the flow of materials, information requirements, procedures, documentation, and feed and food chain coordination. Based on the collected data, prototypes of the traceability system are designed and developed, incorporating the principles and requirements of ISO 22005: Traceability in the Feed and food chain. The prototypes are then evaluated through a survey of local stakeholders in the Pangkhon coffee supply chain, utilizing the User Acceptance Model and statistical analysis techniques. The expected outcomes of this research include increased transparency in the coffee supply chain, value addition to the coffee from Pangkhon, and insights into the acceptance and usability of the traceability system prototypes. The findings from this research will contribute to developing effective traceability systems in the coffee industry, promoting sustainability, trust, and consumer confidence in coffee products.

Keywords: Coffee, Value Chain, Traceability System, Blockchain, Technology Acceptance Model

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ABBREVIATIONS AND SYMBOLS

ISO	International Organization for Standardization
BTC	Blockchain Technology
UTAUT	Unified Theory of Acceptance and Use of Technology
PE	Performance Expectancy
EE	Effort Expectancy
SI	Social Influence
FC	Facilitating Conditions
BI	Behavioral Intention
CR	Composite Reliability
AVE	Average Variance Extracted
PLS-SEM	Partial Least Squares Structural Equation Modeling
R^2	Coefficient of Determination

CHAPTER 1

INTRODUCTION

1.1 Background and Importance of the Research Problem

The coffee industry plays a vital role in the global agricultural sector, with millions of people involved in its cultivation, processing, distribution, and consumption. In 2022–2023, global coffee consumption reached approximately 173 million 60-kg bags, reflecting its continuing economic and social significance worldwide (International Coffee Organization, 2023). In recent years, there has been a growing interest in specialty coffee characterized by its unique flavors and quality, which has elevated the importance of specific coffee-growing regions (Jacobi et al., 2024).

One such region is Pangkhon, located in northern Thailand's Chiang Rai province. Pangkhon has gained recognition for its high-quality Arabica coffee, known for exceptional flavor profiles and increasingly sought after by specialty coffee enthusiasts both locally and internationally (Meesaeng, 2022). In addition to its favorable climatic conditions and dedicated farmers, altitude plays a crucial role in the cultivation of high-quality Arabica. Altitude influences coffee cherry development, maturation rate, and chemical composition, which in turn determine sensory quality. Higher elevations—typically 600 to 2000 meters above sea level—are associated with slower cherry maturation, allowing more complex flavors to develop (Worku et al., 2018; Hu et al., 2024). The unique combination of altitude, temperature, and humidity in Pangkhon therefore provides an ideal environment for cultivating Arabica coffee with a distinctive taste and aroma.

Despite its strengths, Pangkhon's coffee value chain faces a significant challenge: the absence of a robust traceability system. Without systematic mechanisms for verifying origin and production practices, opportunities for value-added marketing and differentiation based on unique regional attributes are limited. Traceability is increasingly recognized in academic literature as critical for food supply chains, ensuring transparency, quality assurance, and sustainability (Aung & Chang, 2014). However, existing solutions are either paper-based and fragmented or overly complex and costly for smallholder

farmers. Furthermore, while blockchain has been promoted as a promising tool for supply chain traceability, its direct adoption in rural coffee-growing regions is constrained by technological and usability barriers. Few studies have examined how international standards such as ISO 22005 can be practically integrated with digital tools to address these challenges in a smallholder context.

To address this gap, this study prototypes a blockchain-inspired traceability system for the Pangkhon coffee value chain. The system is designed in accordance with ISO 22005 standards, incorporates user-friendly interfaces (text, timeline, and map views), and embeds transparency features inspired by blockchain principles. In addition, the study evaluates user acceptance and perceptions of the prototype using the Unified Theory of Acceptance and Use of Technology (UTAUT) model, providing insights into stakeholder readiness for digital traceability adoption. The findings contribute both methodological and practical perspectives on developing feasible traceability solutions that enhance transparency, sustainability, and market opportunities for smallholder-based coffee supply chains. In doing so, this research addresses a critical knowledge gap by operationalizing ISO 22005 within a digital, blockchain-inspired framework tailored for smallholder contexts. The novelty of this work lies in integrating international traceability standards with user-centered design and behavioral acceptance analysis, offering an evidence-based pathway to scale digital traceability in rural coffee-growing regions where such approaches remain underexplored.

1.2 Research Objective

Accordingly, this study was conducted with the following objectives:

1.2.1 To design a prototype traceability system for the coffee value chain in Pangkhon, Chiang Rai, based on the ISO 22005 standard for feed and food chain traceability.

1.2.2 To integrate blockchain-inspired features such as immutability and transparency into the prototype, and to design consumer-facing interfaces (text, timeline, and map views) following practical UX/UI design principles for real-world applicability.

1.2.3 To evaluate user acceptance, perceptions, and behavioral intention toward the traceability system among coffee producers and consumers by applying the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

1.3 The Importance of Research

The research undertaken in this study holds significant importance due to the critical issues faced by the coffee supply chain in Pangkhon, Chiang Rai. The coffee industry's lack of traceability and value addition poses significant challenges that must be addressed. By focusing on designing a prototype traceability system based on the ISO 22005 standard. This research aims to tackle these challenges and make notable contributions to enhancing transparency, quality, sustainability, and value creation within the coffee supply chain.

One of the key reasons this research is important is its ability to address the issue of traceability within the coffee supply chain. Implementing a traceability system will enable the tracking and tracing of coffee beans from their origin to the final consumer, ensuring that accurate and reliable information regarding the coffee's source, cultivation practices, and sustainability efforts are available to consumers. This will promote transparency and accountability within the supply chain, enabling consumers to make informed decisions and fostering trust and confidence in their coffee.

Additionally, this research emphasizes the significance of value addition within the coffee industry. By incorporating a traceability system, coffee from Pangkhon can be differentiated and positioned as a premium product with distinct qualities and sustainability credentials. This can lead to increased market demand, higher value recognition, and improved economic opportunities for local coffee farmers and other stakeholders in the coffee supply chain.

Furthermore, the research contributes to the broader understanding of traceability systems and their application in the agricultural sector. By utilizing the ISO 22005 standard as a guideline for implementing traceability in the coffee supply chain, this research showcases the effectiveness and relevance of traceability in ensuring product integrity, meeting regulatory requirements, and satisfying consumer expectations.

Ultimately, this research holds the potential to have a significant impact not only on Pangkhon's coffee industry but also on the broader coffee sector. It serves as a valuable model for other coffee-producing regions facing similar challenges, encouraging the adoption of traceability systems to enhance transparency, quality, sustainability, and value creation throughout the coffee supply chain.

1.4 Research Questions

1.4.1 What are the specific requirements for designing a prototype traceability system based on the ISO 22005 standard to enhance quality, safety, and sustainability in coffee supply chain management, while also expanding marketing opportunities for Pangkhon coffee?

1.4.2 What factors influence the acceptance and behavioral intention of coffee supply chain stakeholders in Pangkhon toward adopting a blockchain-inspired traceability system?

1.4.3 What is the most suitable prototype traceability system for application among Pangkhon coffee stakeholders, considering both technical feasibility and user acceptance?

1.5 Scopes of Research

This research focuses on investigating the traceability system in the coffee supply chain of Pangkhon, Chiang Rai, with an emphasis on enhancing transparency, quality assurance, sustainability, and value creation. The study specifically examines the challenges and limitations of the current traceability practices and proposes a prototype solution designed in accordance with the ISO 22005 standard. The prototype incorporates blockchain-inspired features such as immutability and transparency, along with user-friendly interfaces including text, timeline, and map views, to provide a practical and accessible system for smallholder-based supply chains.

The scope of the study is limited to the Pangkhon area, which is widely recognized for its high-quality Arabica coffee and its growing role in Thailand's

specialty coffee market. Data are collected from local stakeholders across the coffee value chain, including farmers, processors, distributors, retailers, and consumers, in order to capture their perspectives, experiences, and requirements related to traceability. The research framework is guided by ISO 22005, which defines objectives, product flows, information requirements, regulatory compliance, and coordination mechanisms for feed and food chain traceability.

In addition to system design, the study also evaluates the proposed prototype by applying the Unified Theory of Acceptance and Use of Technology (UTAUT) model. This allows for an assessment of stakeholder usability, effectiveness, and acceptance of the system, providing insights into performance expectancy, effort expectancy, social influence, and behavioral intention.

It should be noted that the findings of this research are specific to the Pangkhon coffee supply chain and may not be directly generalizable to other regions or industries. Nevertheless, the results contribute to the broader understanding of traceability in agricultural contexts and demonstrate how international standards and blockchain-inspired features can be operationalized in smallholder-based coffee value chains to strengthen authenticity, competitiveness, and long-term sustainability.

CHAPTER 2

LITERATURE REVIEW

2.1 Pangkhon Coffee Supply Chain

Pangkhon, located in Huay Chomphu Subdistrict, Mueang District, Chiang Rai Province, is recognized as one of Thailand's key Arabica coffee-producing areas, particularly due to its favorable highland conditions that support high-quality coffee cultivation (Meesaeng, 2022). The local coffee supply chain involves multiple stakeholders, beginning with farmers and extending through processors, exporters, retailers, and consumers. Each stage contributes to the value and identity of Pangkhon coffee, which has increasingly gained recognition in both domestic and international specialty markets.

At the production stage, farmers grow and care for Arabica coffee trees in highland areas and typically harvest ripe cherries (90–100%) by hand to ensure quality. These cherries are then transferred to processors, who employ wet methods for depulping, washing, and, if applicable, fermenting. After processing, beans are sun-dried on concrete patios for 7–10 days, during which they are turned regularly to ensure even drying (Highland Agricultural Development Station, n.d.).

Exporters and roasters play a central role in maintaining quality consistency and meeting market preferences. Beans are roasted at carefully controlled temperatures ranging from 120–300°C, depending on the target roast profile. This process allows exporters and roasters to supply specialty cafés and distributors with coffee that highlights Pangkhon's unique sensory characteristics. Retailers then sort and package the roasted beans, often labeling them with "Pangkhon origin" to emphasize their provenance before distributing them through specialty shops, cafés, or online channels (Meesaeng, 2022).

Finally, the coffee reaches consumers, including both domestic customers—such as local cafés, tourists, and Thai coffee drinkers—and international buyers, particularly specialty importers from markets such as Japan, Korea, and Europe. This

structured supply chain, illustrated in Figure 2.1, underscores the collaborative nature of Pangkhon coffee production and distribution and highlights the importance of effective coordination among stakeholders to preserve quality and authenticity.

Figure 2.1 Pangkhon Coffee Supply Chain Process (Farmer to Consumer)

2.2 Traceability Standards in the Coffee Supply Chain

ISO 22005:2007 establishes the general principles and basic requirements for the design and implementation of traceability systems in feed and food supply chains. The standard is applicable to all stages of the supply chain, from raw material acquisition through processing, distribution, and delivery of the final product to consumers (International Organization for Standardization [ISO], 2007). A robust traceability system ensures that product origin can be verified, movements can be monitored across the chain, and mechanisms for food safety and quality assurance are reinforced.

The standard highlights several critical aspects of traceability implementation. These include defining clear objectives, establishing the flow of materials and information, ensuring accurate lot identification, and maintaining written procedures that can be audited and systematically reviewed. To achieve effective traceability, ISO 22005 identifies three fundamental actions: (1) Identify – determine the relevant entities, products, and processes within the chain; (2) Capture – collect and record accurate data at each stage; and (3) Share – transmit verified information to the subsequent actor in the supply chain.

When applied to the coffee sector, ISO 22005 provides a framework that can enhance transparency, authenticity, and sustainability across the value chain. By systematically documenting production practices and product flows, it allows for both quality assurance and value differentiation in specialty markets. However, while the standard offers comprehensive guidelines, its practical implementation in smallholder-

based systems such as Pangkhon remains a challenge due to resource limitations and reliance on paper-based records.

2.3 Traceability Technologies

Traceability technologies in the food supply chain encompass a range of tools designed to capture, store, and transmit information about product movement across the value chain. These technologies are critical for transparency, accountability, and compliance with food safety standards. Supply chain traceability systems depend on clear data models and interoperable technologies that enable information sharing among stakeholders (Bechini et al., 2008).

Among the most widely implemented technologies are barcodes and QR codes, which remain affordable and accessible. These tools facilitate product identification, recall management, and consumer access to supply chain information. However, their limited data storage capacity and reliance on manual scanning constrain their scalability (Lukacs et al., 2025).

Radio Frequency Identification (RFID) offers real-time, automated tracking that enhances supply chain visibility. Despite these advantages, adoption remains limited due to high costs, infrastructure requirements, and technological complexity (Zhang et al., 2025). Similarly, Electronic Data Interchange (EDI) enables standardized business document exchange between partners, reducing information silos and improving traceability. Collaborative e-business frameworks supported by EDI strengthen supply chain integration, though adoption requires harmonization of systems and significant investment (Bechini et al., 2008).

Geographical Information Systems (GIS) and Global Positioning Systems (GPS) contribute to food traceability by monitoring transport routes, verifying product origin, and assessing storage conditions. Integration with Internet of Things (IoT) sensors further improves location accuracy and supply chain resilience (Ben-Daya et al., 2019). In lower-infrastructure contexts, batch and lot coding remain essential mechanisms for product tracking, as they provide structured traceability even in partially digitalized systems (Bechini et al., 2008).

In recent years, digital data management platforms and traceability software have gained prominence for integrating heterogeneous sources of supply chain data, enabling analytics, and supporting decision making (Bechini et al., 2008). Meanwhile, blockchain technology has emerged as a promising solution for immutable and decentralized traceability. Lin et al. (2019) demonstrate a blockchain-based food traceability system using EPCIS, highlighting its ability to enhance transparency, trust, and consumer confidence.

Despite these advantages, blockchain adoption in agri-food supply chains—particularly in developing countries—faces considerable barriers. Challenges include limited digital literacy among smallholder farmers, inadequate infrastructure, and usability issues. In many cases, blockchain-based systems are too complex, costly, or poorly adapted to rural socio-economic conditions, limiting their scalability and acceptance. These constraints underscore the need for simplified, user-centered solutions that integrate international traceability standards with locally adapted digital tools.

In summary, while traditional technologies such as barcodes and batch coding remain dominant due to accessibility and affordability, emerging solutions such as RFID, IoT, and blockchain offer opportunities to improve accuracy, interoperability, and consumer trust in global agri-food supply chains.

Table 2.1 Traceability Technologies: Description, Benefits, and Limitation

Traceability Technology	Description	Benefits	Limitation
Barcodes and QR Codes	These technologies use unique codes that can be scanned to capture product information, such as batch numbers and origin.	Improved inventory management, accurate product identification, and efficient recall management.	Limited data capacity, prone to damage, requires direct line-of-sight scanning.

Table 2.1 (continued)

Traceability Technology	Description	Benefits	Limitation
Radio Frequency Identification (RFID)	RFID utilizes tags and readers to track products, providing real-time visibility and detailed information.	Enhanced supply chain visibility, reduced manual data entry errors, and improved inventory accuracy.	High implementation cost, interference issues, privacy concerns.
Electronic Data Interchange (EDI)	EDI enables the electronic exchange of standardized business documents between trading partners, facilitating efficient data sharing.	Streamlined communication, reduced paperwork, and improved accuracy in transactional data.	High setup and maintenance costs, limited flexibility, requires standardized systems between partners.
Global Positioning System (GPS) and Geographical Information Systems (GIS)	GPS and GIS technologies track and link product movement to specific geographic locations.	Effective monitoring of transportation routes, improved quality control, and accurate delivery tracking.	Requires strong signal, limited accuracy in dense or obstructed areas, high operating cost.

Table 2.1 (continued)

Traceability Technology	Description	Benefits	Limitation
Batch/Lot Numbers and Product Coding	Unique identification numbers or codes are assigned to product batches or lots for easy traceability.	Efficient recall management, improved inventory control, and enhanced product authenticity verification.	Manual errors possible, not real-time, limited ability to track dynamic changes in supply chain.
Paper-based Records and Documentation	Traditional manual record-keeping methods, such as logbooks and forms, document product information.	Easy data entry, cost-effective solution, and availability in low-tech environments.	Prone to human error, time-consuming, difficult to integrate with digital systems.
Data Management Systems and Traceability Software	Specialized software and data management platforms collect, store, and analyze traceability data.	Streamlined data retrieval and analysis, improved decision-making, and enhanced supply chain visibility.	Requires technical expertise, expensive to develop and maintain, data security concerns.

Table 2.1 (continued)

Traceability Technology	Description	Benefits	Limitation
Blockchain Technology	Blockchain provides a secure and transparent record of transactions and traceability information.	Enhanced data security, improved transparency, and increased trust among supply chain stakeholders.	High energy use (for public chains), limited scalability, high implementation cost, complex integration with existing systems, and irreversible errors once data is recorded.

2.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was introduced by Venkatesh et al. (2003) as a comprehensive framework that synthesizes eight prior models of technology acceptance. The model emphasizes four core constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs are moderated by demographic and contextual factors such as age, gender, experience, and voluntariness.

Building upon the original framework, UTAUT2 extended its applicability to consumer contexts by incorporating additional constructs, including hedonic motivation, price value, and habit. This extension has made the model more suitable for examining adoption behavior beyond organizational settings (Venkatesh et al., 2012).

Recent applications have demonstrated the relevance of UTAUT in agricultural and supply chain contexts. For instance, Toader et al. (2024) applied an extended UTAUT model to investigate blockchain adoption in agri-food supply chains. Their findings emphasized the role of both technological factors (e.g., perceived usefulness

and ease of use) and social influences (e.g., trust and collaboration among stakeholders) in shaping acceptance.

In this study, UTAUT provides the theoretical foundation for evaluating user acceptance of the proposed coffee traceability system prototype. The framework allows for a systematic assessment of stakeholder perceptions across the Pangkhon coffee value chain and helps to identify behavioral drivers and barriers that influence adoption in a smallholder agricultural context. By applying UTAUT, this research ensures that both technological design and user acceptance are considered in the development of a feasible traceability solution.

CHAPTER 3

METHODOLOGY

3.1 Research Methodology Framework

The research methodology framework was developed in three phases, as shown in Figure 3.1. This study adopted a three-phase methodological approach to design, prototype, and evaluate a traceability system for the coffee supply chain in Pangkhon, Chiang Rai.

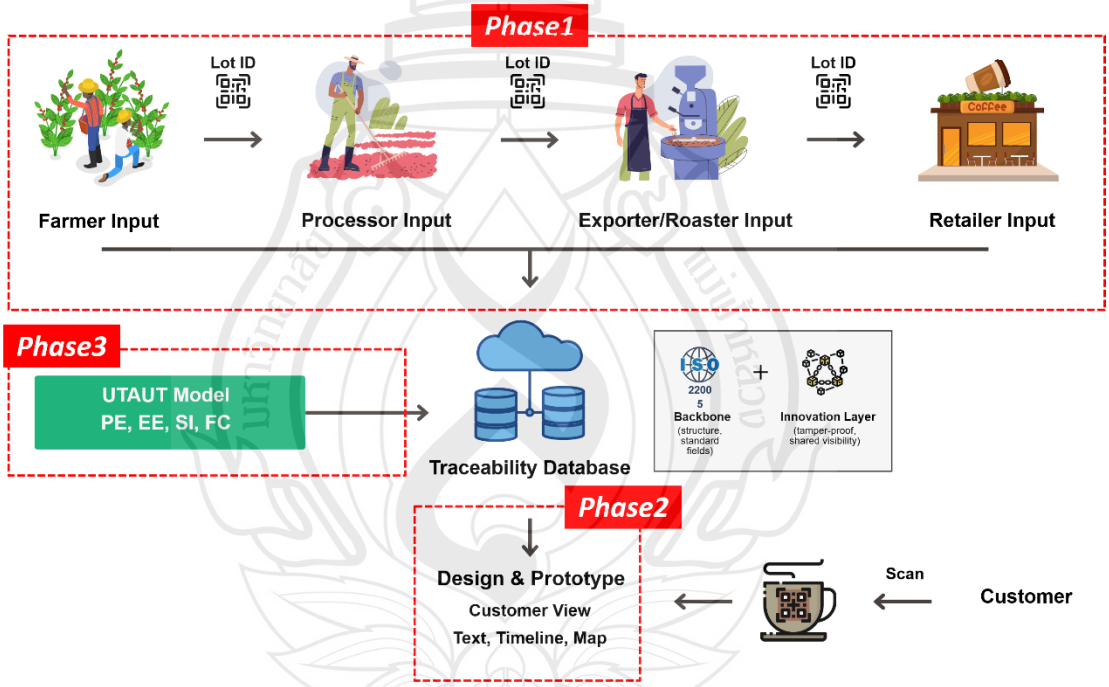

Figure 3.1 Research Methodology Framework

The framework illustrates the three phases of the research: Phase 1 – data collection from stakeholders (farmer to retailer) under ISO 22005, Phase 2 – prototype design with text, timeline, and map views, and Phase 3 – evaluation using UTAUT (PE, EE, SI, FC).

In Phase 1, data were collected from stakeholders across the supply chain, from farmers to retailers, following the guidelines of ISO 22005. Phase 2 involved the design of a prototype traceability system incorporating text, timeline, and map views. Phase 3 focused on evaluating the prototype using the Unified Theory of Acceptance and Use of Technology (UTAUT), specifically assessing performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC).

3.2 Phase 1: Data Collection

Data collection was conducted through focus group interviews with stakeholders and the review of secondary sources, including existing supply chain documentation. The goal was to define input requirements for each actor in accordance with the ISO 22005:2007 guidelines for system design and implementation (International Organization for Standardization [ISO], 2007). Literature on food traceability and SME-focused analyses (Curto & Gaspar, 2021), as well as international guidelines for agricultural products (International Trade Centre, 2015), further informed the data framework.

Essential traceability attributes were identified for each stage of the coffee value chain:

1. Farmers: identification (ID, name), geolocation, varietal, planting and harvest details, and input usage records.
2. Processors: processing methods, fermentation and drying parameters, grading, and batch identifiers.
3. Roasters/Exporters: roasting profiles, equipment, batch linkage, and timestamps.
4. Retailers: brand information, product type, roasting date, and expiration date.
5. Consumers: interaction via QR code scanning.

This ISO 22005–aligned structure ensures compliance with international standards and practical applicability for smallholder-based value chains.

3.3 Phase 2: Prototype Design

Based on the collected requirements, a conceptual prototype was developed following a mobile-first design strategy. The design emphasized usability for heterogeneous stakeholders and presented consumer-facing views in three formats:

1. Text-based records,
2. Timeline-based visualization, and
3. Geospatial map-based traceability.

The design approach was informed by reviews of blockchain-based agri-food traceability interfaces (Tharatipyakul & Pongnumkul, 2021), ensuring alignment with best practices in user experience (UX) and usability.

The prototype consisted of nine interactive screens: login and role selection, data input forms for farmers, processors, exporters, and retailers, consumer QR scanning, and three alternative consumer views (text, timeline, map). This modular design enabled testing of usability across multiple perspectives of the supply chain.

Figure 3.2 Prototype Screens of the Coffee Traceability System

The prototype consists of nine interactive screens: (a) Login & Role Selection, (b) Farmer Input Form, (c) Processor Input Form, (d) Exporter Input Form, (e) Retailer Input Form, (f) Customer QR Scan Screen, (g) Consumer View – Text-Based, (h) Consumer View – Timeline-Based, and (i) Consumer View – Map-Based. These screens were designed following a mobile-first approach to ensure usability for diverse stakeholders in the Pangkhon coffee supply chain.

3.4 Phase 3: Prototype Evaluation

The system was evaluated using the Unified Theory of Acceptance and Use of Technology (UTAUT), a widely adopted framework for assessing technology adoption (Venkatesh et al., 2003). UTAUT constructs—performance expectancy, effort expectancy, social influence, and facilitating conditions—were operationalized into a 12-item questionnaire. Questions were adapted to the traceability context following prior studies on user acceptance of traceability systems (Susanty et al., 2023).

A total of 31 respondents participated, representing five stakeholder groups: 11 farmers, 5 processors, 5 exporters/roasters, 5 retailers, and 5 consumers. Data were collected via an online survey distributed through Google Forms, employing a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

The questionnaire comprised three sections:

1. General demographic and digital literacy information,
2. Prototype evaluation using UTAUT constructs, and
3. Open-ended feedback on usability and improvement.

This multi-stakeholder evaluation provided insights into both perceived usability and intention to adopt the system within real-world coffee supply chains.

CHAPTER 4

RESULTS AND ANALYSIS

4.1 Measurement Model

The reliability and validity of the measurement model were assessed using Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Table I summarizes the results.

Table 4.1 Reliability and Validity of Constructs (Cronbach's Alpha, Composite Reliability, and AVE)

Construct	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
BI	0.794	0.824	0.906	0.828
EE	0.819	0.839	0.891	0.731
FC	0.687	1.091	0.844	0.734
PE	0.614	0.826	0.787	0.578
SI	0.709	0.746	0.871	0.771

Cronbach's alpha values for most constructs were greater than 0.70, indicating acceptable internal consistency (Nunnally & Bernstein, 1994). However, Facilitating Conditions (FC = 0.687) and Performance Expectancy (PE = 0.614) fell slightly below this threshold but can still be considered tolerable in exploratory research (Hair et al., 2017). Composite Reliability (ρa and ρc) values for all constructs exceeded the recommended cutoff of 0.70, demonstrating strong internal reliability (Nunnally & Bernstein, 1994; Hair et al., 2017). Similarly, all constructs exhibited AVE values above 0.50, confirming satisfactory convergent validity (Fornell & Larcker, 1981).

Discriminant validity was examined using cross-loadings of indicators, as shown in Table II. Most indicators loaded highest on their intended constructs, supporting discriminant validity (Fornell & Larcker, 1981). Nevertheless, a few items

(e.g., PE1 and PE3) showed stronger cross-loadings on BI and FC, respectively. This suggests that some items may not fully capture the intended construct and could be refined or removed in future research to strengthen construct validity.

In addition, while reliability and validity measures were satisfactory, model fit indices were not reported. For a more comprehensive evaluation, future analyses should incorporate fit statistics such as the Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), and Chi-square values, which are commonly applied in PLS-SEM studies to assess overall model adequacy (Hair et al., 2017).

Table 4.2 Cross Loadings of Indicators

Indicator	BI	EE	FC	PE	SI
BI1	0.888	0.716	0.486	0.683	0.708
BI2	0.931	0.826	0.675	0.922	0.943
EE1	0.622	0.81	0.648	0.665	0.771
EE2	0.642	0.914	0.73	0.593	0.805
EE3	0.865	0.839	0.64	0.671	0.819
FC1	0.287	0.393	0.738	0.299	0.32
FC2	0.702	0.831	0.961	0.781	0.823
PE1	0.931	0.826	0.675	0.922	0.943
PE2	0.643	0.424	0.401	0.856	0.606
PE3	0.276	0.385	0.715	0.388	0.275
SI1	0.686	0.75	0.724	0.782	0.842
SI2	0.907	0.887	0.622	0.782	0.913

In conclusion, the measurement model demonstrates overall acceptable reliability and validity, with only minor issues observed that warrant refinement in subsequent studies.

4.2 Demographic Profile

This study gathered data from two primary respondent groups: coffee producers and coffee consumers.

For the producer group, respondents represented key roles across the coffee supply chain, including farmers, processors, exporters, and retailers. The majority of producers were aged 31–40 years, followed by those aged 21–30 years, indicating that the sector is predominantly driven by young and middle-aged stakeholders actively engaged in production and trade. Most producers reported owning a smartphone and using digital tools regularly, which suggests readiness for the adoption of digital traceability systems in line with ISO 22005–based guidelines.

For the consumer group, most respondents were in the 21–30 years age category, with a smaller proportion aged 31–40 years. Coffee consumption habits revealed that the majority of consumers drank coffee daily, while some reported occasional consumption. Importantly, most consumers expressed a clear interest in coffee origin information, demonstrating awareness of sustainability and transparency issues in the coffee supply chain.

When evaluating system usage preferences, consumers favored the Map View for accessing traceability information, followed by Timeline View and Text View. This preference highlights the importance of visual and interactive formats in enhancing user engagement and understanding.

Overall, the demographic distribution demonstrates a balanced representation of stakeholders across both production and consumption sides of the value chain. The prevalence of digitally literate respondents, particularly among younger age groups, provides a strong foundation for evaluating the usability and acceptance of the proposed coffee traceability prototype.

Notably, respondents aged 21–30, who can be considered digital natives, reported slightly higher scores in Behavioral Intention (BI) compared to older groups, suggesting that younger stakeholders are more likely to adopt digital traceability systems. This pattern underscores the role of generational differences and digital familiarity in shaping technology acceptance in rural supply chains.

Table 4.3 Demographic Profile of Processors

Construct	Processors				Age			Smartphone		Digital Usage	
	Farmer	**Processor**	**Exporter**	**Retailer**	**21-30**	**31-40**	**41-50**	**Have**	**Don't Have**	**Yes**	**No**
PE	4.67	4.67	4.67	4.8	4.67	4.65	5.0	4.69	-	4.69	4.83
EE	4.27	4.2	4.4	4.6	4.14	4.31	5.0	4.35	-	4.35	4.33
SI	4.45	4.4	4.4	4.7	4.36	4.44	5.0	4.48	-	4.48	4.5
FC	4.59	4.5	4.7	4.6	4.43	4.59	5.0	4.6	-	4.6	4.75
BI	4.64	4.6	4.6	4.8	4.71	4.56	5.0	4.65	-	4.65	4.75

Table 4.4 Demographic Profile of Customers

Construct	Age		Do you regularly drink coffee?		Coffee origin interest	
	21-30	**31-40**	**Everyday**	**Sometimes**	**Yes**	**No**
PE	4.44	5.0	4.58	5.0	4.58	5.0
EE	4.33	5.0	4.67	4.33	4.67	4.33
SI	4.5	5.0	4.75	4.5	4.75	4.5
FC	4.67	5.0	4.75	5.0	4.75	5.0
BI	4.5	5.0	4.63	5.0	4.63	5.0

4.3 Descriptive Statistics

Descriptive statistics were calculated for the 12 measurement indicators across the five constructs: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), and Behavioral Intention (BI). Table 4.5 presents the mean, standard deviation (SD), minimum, and maximum values of all indicators.

The results showed that the mean scores ranged from 4.4 to 4.8, indicating that respondents generally provided favorable responses toward the proposed traceability system. Among all indicators, PE1, EE3, SI2, FC1, FC2, and BI2 achieved the highest mean score of 4.8, reflecting very positive perceptions.

Standard deviation values ranged between 0.44 and 0.89, suggesting relatively low variability in responses. The minimum and maximum scores across indicators ranged from 3 to 5, confirming consistency in the scale distribution.

These results suggest that the measurement data are reliable and appropriate for further structural model analysis (Hair et al., 2017).

Table 4.5 Descriptive Statistics for Measurement Indicators (Mean, SD, Min, Max)

Indicator	Mean	SD	Min	Max
PE1	4.8	0.45	4	5
PE2	4.6	0.89	3	5
PE3	4.6	0.89	3	5
EE1	4.4	0.55	4	5
EE2	4.6	0.55	4	5
EE3	4.8	0.55	4	5
SI1	4.6	0.45	4	5
SI2	4.8	0.65	4	5
FC1	4.8	0.55	4	5
FC2	4.8	0.75	4	5
BI1	4.6	0.44	4	5
BI2	4.8	0.55	4	5

4.4 Structural Model (PLS-SEM)

The structural model was assessed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate the hypothesized relationships among the constructs. Figure 4.1 and Table 4.6 present the results of the path analysis.

The model explained 89.8% of the variance in Behavioral Intention (BI) (R^2 = 0.898), indicating a high predictive power of the structural model (Hair et al., 2011, Hair et al., 2014).

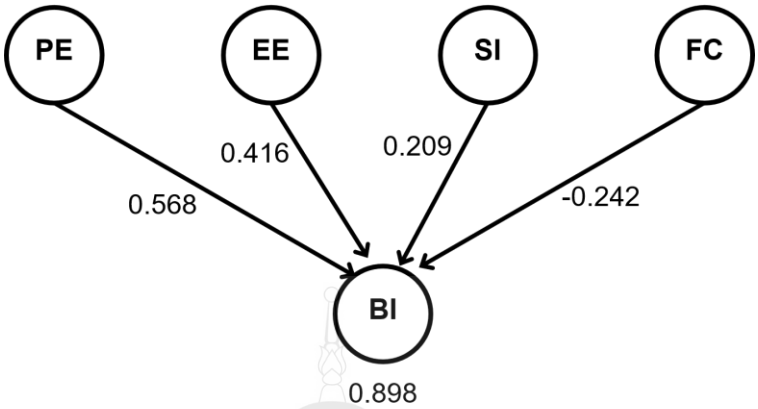

Figure 4.1 Structural Model Results

Table 4.6 Path Coefficients and Hypothesis Testing Results

Relationship	Path Coefficient (β)	p-value	Result
PE → BI	0.568	< 0.05	Significant
EE → BI	0.416	< 0.05	Significant
SI → BI	0.209	< 0.05	Significant
FC → BI	-0.242	< 0.05	Significant (Negative)

The results show that Performance Expectancy (PE) had the strongest positive influence on BI (β=0.568), followed by Effort Expectancy (EE) (β=0.416) and Social Influence (SI) (β=0.209). Interestingly, Facilitating Conditions (FC) had a significant but negative effect on BI (β=−0.242), suggesting that while infrastructure and resources are available, they may create dependency or reduce intrinsic motivation to adopt the system.

These findings highlight that users' expectations of system performance and ease of use are the primary drivers of behavioral intention, consistent with prior studies applying the Unified Theory of Acceptance and Use of Technology (UTAUT) (Ringle et al., 2015; Venkatesh et al., 2003). However, the negative effect of facilitating conditions (FC) suggests that infrastructural availability alone does not guarantee adoption; in fact, it may indicate a misalignment between the support provided and actual user needs. Reporting additional model fit indices such as the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI) would further

strengthen the robustness of these findings and allow for more nuanced comparisons with prior UTAUT-based PLS-SEM studies.

CHAPTER 5

CONCLUSION AND DISCUSSION

5.1 Conclusion

This study applied Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the adoption of a coffee traceability system in Pangkhon, Chiang Rai. The results indicated that Performance Expectancy (PE), Effort Expectancy (EE), and Social Influence (SI) significantly influenced the intention to adopt the system. Although Facilitating Conditions (FC) and PE had slightly low Cronbach's Alpha values (below 0.7), the measurement model still demonstrated acceptable reliability and strong validity (Nunnally & Bernstein, 1994; Hair et al., 2017). Interestingly, FC exerted a negative effect on Behavioral Intention (BI), suggesting possible mismatches in support systems or infrastructure. The structural model explained 89.8% of the variance in BI ($R^2 = 0.898$), highlighting strong predictive capability (Hair et al., 2011; Hair et al., 2014).

5.2 Discussion

The findings offer several important insights when compared with global research. First, Performance Expectancy (PE) had a significant positive effect on Behavioral Intention (BI), consistent with prior studies that emphasize perceived usefulness as a central determinant of technology adoption (Kamble et al., 2020; Galvez et al., 2018). Second, Effort Expectancy (EE) positively influenced BI, reinforcing the importance of user-friendly designs in settings where technological expertise is limited (Wamba et al., 2020; Tian, 2016). Third, Social Influence (SI) was also significant, demonstrating that farmer networks and peer communities shape technology acceptance in agricultural contexts (Chang et al., 2020; Jensen et al., 2019).

In contrast, Facilitating Conditions (FC) demonstrated a negative effect on BI. While FC is typically expected to have a positive role, this result suggests that the presence of infrastructure and resources does not guarantee adoption if these supports are misaligned with local needs. This outcome indicates a contextual difference from findings in developed economies, where infrastructure tends to consistently reinforce adoption (Mbadlisa & Jokonya, 2024; Agbo et al., 2019). Theoretically, this study confirms the applicability of the UTAUT framework in a smallholder coffee supply chain while also extending the model by highlighting how FC may operate differently in rural, resource-constrained contexts.

From a practical perspective, the results provide a basis for designing localized implementation strategies. Local cooperatives, community-based organizations, and extension services could use the proposed prototype as a model for promoting transparency and value addition in coffee supply chains. By tailoring training programs, offering simple mobile-based interfaces, and integrating traceability into cooperative marketing, the system could strengthen farmer participation and consumer trust. Additionally, linking the system with e-commerce platforms could expand market opportunities for Pangkhon coffee, particularly among younger consumers who demonstrated higher digital readiness.

5.3 Study Limitations and Recommendations

This study is limited by its single-location focus in Pangkhon, Chiang Rai, and a relatively small sample size (n = 31), which restricts generalization. To overcome these limitations, future studies should expand to larger and more diverse coffee-producing regions across northern Thailand and beyond. Testing the system in vertically integrated supply chains or within large-scale cooperative structures could provide more robust evidence of scalability. Furthermore, exploring integration with digital marketplaces and e-commerce platforms would offer insights into how traceability can directly enhance farmers’ access to premium markets.

REFERENCES

Agbo, C. C., Mahmoud, Q. H., & Eklund, J. M. (2019). Blockchain technology in healthcare: A systematic review. *Healthcare, 7*(2), 56. https://doi.org/10.3390/healthcare7020056

Aung, M. M., & Chang, Y. S. (2014). Traceability in a food supply chain: Safety and quality perspectives. *Food Control, 39*, 172–184. https://doi.org/10.1016/j.foodcont.2013.11.007

Bechini, A., Cimino, M. G. C. A., Marcelloni, F., & Tomasi, A. (2008). Patterns and technologies for enabling supply chain traceability through collaborative e-business. *Information and Software Technology, 50*(4), 342–359. https://doi.org/10.1016/j.infsof.2007.02.017

Ben-Daya, M., Hassini, E., & Bahroun, Z. (2019). Internet of things and supply chain management: A literature review. *International Journal of Production Research, 57*(15–16), 4719–4742. https://doi.org/10.1080/00207543.2017.1402140

Chang, Y., Iakovou, E., & Shi, W. (2020). Blockchain in global supply chains and cross border trade: A critical synthesis of the state-of-the-art, challenges and opportunities. *International Journal of Production Research, 58*(7), 2082–2099. https://doi.org/10.1080/00207543.2019.1651946

Curto, J. P., & Gaspar, P. D. (2021). Traceability in food supply chains: Review and SME focused analysis—Part 1. *AIMS Agriculture and Food, 6*(2), 679–707. https://doi.org/10.3934/agrfood.2021041

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.2307/3151312

Galvez, J. F., Mejuto, J. C., & Simal-Gandara, J. (2018). Future challenges on the use of blockchain for food traceability analysis. *TrAC Trends in Analytical Chemistry, 107*, 222–232. https://doi.org/10.1016/j.trac.2018.08.011

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Richter, N. F., & Hauff, S. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). Sage. https://doi.org/10.15358/9783800653614

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*, *26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Highland Agricultural Development Station. (n.d.). *Pangkhon coffee supply chain*. Royal Initiative Project, Baan Pangkhon, Huay Chomphu Subdistrict, Mueang District, Chiang Rai Province.

Hu, R., Xu, F., Chen, X., Kuang, Q., Xiao, X., & Dong, W. (2024). The growing altitude influences the flavor precursors, sensory characteristics and cupping quality of the Pu'er coffee bean. *Foods*, *13*(23), 3842. https://doi.org/10.3390/foods13233842

International Coffee Organization. (2023, November). *Annual review 2022–2023*. https://www.icocoffee.org/documents/cy2023-24/annual-review-2022-2023-e.pdf

International Organization for Standardization (ISO). (2007). *ISO 22005:2007 Traceability in the feed and food chain – General principles and basic requirements for system design and implementation*. ISO.

International Trade Centre (ITC). (2015). *Traceability in food and agricultural products*. ITC.

Jacobi, J., Lara, D., Opitz, S., de Castelberg, S., Urioste, S., Irazoque, A., . . . Yeretzian, C. (2024). Making specialty coffee and coffee-cherry value chains work for family farmers' livelihoods: A participatory action research approach. *World Development Perspectives*, *33*, 100551. https://doi.org/10.1016/j.wdp.2023.100551

Jensen, T., Hedman, J., & Henningsson, S. (2019). How TradeLens delivers business value with blockchain technology. *MIS Quarterly Executive, 18*(4), 5. https://aisel.aisnet.org/misqe/vol18/iss4/5

Kamble, S. S., Gunasekaran, A., & Sharma, R. (2020). Modeling the blockchain enabled traceability in agriculture supply chain. *International Journal of Information Management, 52*, 101967. https://doi.org/10.1016/j.ijinfomgt.2019.05.023

Lin, Q., Wang, H., Pei, X., & Wang, J. (2019). Food traceability system based on blockchain and EPCIS. *IEEE Access, 7*, 20698–20707. https://doi.org/10.1109/ACCESS.2019.2897792

Lukacs, M., Toth, F., Horvath, R., Solymos, G., Alpár, B., Varga, P., . . . Friedrich, L. (2025). Advanced digital solutions for food traceability: Enhancing origin, quality, and safety through NIRS, RFID, blockchain, and IoT. *Journal of Sensor and Actuator Networks, 14*(1), 21. https://doi.org/10.3390/jsan14010021

Meesaeng, S. (2022). *Growing coffee for sustainable agriculture: Pangkhon village in Chiang Rai*. https://th.boell.org/en/2022/07/15/coffee-chiangrai

Mbadlisa, G., & Jokonya, O. (2024). Factors affecting the adoption of blockchain technologies in food supply chains. *Frontiers in Sustainable Food Systems, 8*, 1497599. https://doi.org/10.3389/fsufs.2024.1497599

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill. https://doi.org/10.1007/BF02301419

Ringle, C. M., Wende, S., & Becker, J. (2015). *SmartPLS 3*. SmartPLS GmbH.

Susanty, A., Akhsan, F. A., & Puspitasari, N. B. (2023, December). Modeling the users' acceptance and perceived usability for halal traceability system. In *2023 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)* (pp. 1093–1097). IEEE. https://doi.org/10.1109/IEEM58616.2023.10406594

Tharatipyakul, A., & Pongnumkul, S. (2021). User interface of blockchain-based agri-food traceability applications: A review. *IEEE Access, 9*, 82909–82929. https://doi.org/10.1109/ACCESS.2021.3085982

Tian, F. (2016). An agri-food supply chain traceability system for China based on RFID and blockchain technology. In *2016 13th International Conference on Service Systems and Service Management (ICSSSM)* (pp. 1–6). IEEE. https://doi.org/10.1109/ICSSSM.2016.7538424

Toader, D.-C., Rădulescu, C. M., & Toader, C. (2024). Investigating the adoption of blockchain technology in agri-food supply chains: Analysis of an extended UTAUT model. *Agriculture, 14*(4), 614. https://doi.org/10.3390/agriculture14040614

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly, 36*(1), 157–178. https://doi.org/10.2307/41410412

Wamba, S. F., Kamdjoug, J. R. K., Bawack, R. E., & Keogh, J. G. (2020). Bitcoin, blockchain and fintech: A systematic review and case studies in the supply chain. *Production Planning & Control, 31*(2–3), 115–142. https://doi.org/10.1080/09537287.2019.1631460

Worku, M., de Meulenaer, B., Duchateau, L., & Boeckx, P. (2018). Effect of altitude on biochemical composition and quality of green Coffea arabica beans. *Food Research International, 105,* 278-285. https://doi.org/10.1016/j.foodres.2017.11.016

Zhang, Y., Lin, Y., & Esfahbodi, A. (2025). Digital transformations of supply chain management via RFID technology: A systematic literature review. *Journal of Digital Economy*. https://doi.org/10.1016/j.jdec.2025.06.001

APPENDIX

PUBLICATIONS

The following publication has been produced from this research work:

Surarityothin, P., Kamhangwong, D., Fuggate, P., & Wicha, S. (2022). The finding of factors to motivate stakeholders in the coffee supply chain towards the use of blockchain technology: Case of Chiang Rai coffee supply chain. In *2022 6th International Conference on Information Technology (InCIT)* (pp. 422–427). IEEE. https://doi.org/10.1109/InCIT56086.2022.10067349

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