RESEARCH ON THAILAND-CHINA AGRICULTURAL PRODUCT TRADING FINANCIAL SUPPLY CHAIN

YONGTAO SHEN

A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Doctor of Philosophy in Logistics and Supply Chain
2023

RESEARCH ON THAILAND-CHINA AGRICULTURAL PRODUCT TRADING FINANCIAL SUPPLY CHAIN

YONGTAO SHEN

A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Doctor of Philosophy in Logistics and Supply Chain
2023

Thesis entitled "Research on Thailand-China Agricultural Product Trading Financial Supply Chain "

By Yongtao Shen

has been approved by the Graduate School as partial fulfillment of the requirements for the Doctor of Philosophy in Logistics and Supply Chain of Naresuan University

Oral Defense Committee

..... Chair
(Associate Professor Chackrit Duangphastra, Ph.D.)

..... Advisor
(Boonsub Panichakarn, Ph.D.)

..... Internal Examiner
(Jessada Pochan, Ph.D.)

..... Internal Examiner
(Associate Professor Vatcharapol Sukhotu, Ph.D.)

..... External Examiner
(Associate Professor Preda Pichayapan, Ph.D.)

Approved

.....
(Associate Professor Krongkarn Chootip, Ph.D.)
Dean of the Graduate School

Title	RESEARCH ON THAILAND-CHINA AGRICULTURAL PRODUCT TRADING FINANCIAL SUPPLY CHAIN
Author	Yongtao Shen
Advisor	Boonsub Panichakarn, Ph.D.
Academic Paper	Ph.D. Dissertation in Logistics and Supply Chain, Naresuan University, 2023
Keywords	Supply Chain Management, Agricultural Product, Trade, Financial Supply Chain Management, Bibliometrics, System Dynamic

ABSTRACT

Agricultural products and trade play a vital role in human survival and economic well-being. With the advancement of management science, supply chain management has emerged as a sustainable management approach. In addition, it is observed that financial issues often pose significant challenges for agricultural enterprises, particularly small and medium-sized ones, acting as the last straw that breaks the camel's back. Therefore, the financial supply chain of agricultural product trade deserves attention. China and Thailand are critical partners in agricultural product trade, making them representative and valuable subjects of study in the context of supply chain management.

This research aims to bridge the gap in understanding agricultural trade supply chains and explore the current status of the financial supply chain management in Thailand-China agricultural product trade. The study will provide the view of agricultural trade supply chains and simulate the financial supply chain of Thailand-China agricultural product trade as its research objectives. The research will employ CiteSpace, a bibliometric tool, to review and analyze the past decade's researches on agricultural trade supply chain, highlighting the research hotspots and future directions in the context of sustainable development. Additionally, the research will utilize VenSim, a system dynamics tool, to illustrate the process of Thai agricultural products' export to China and simulate the current state of the Thailand-China agricultural product trading financial supply chain.

Finally, based on the literature review and research findings, this study will provide recommendations and offer insights into future research in this field.

ACKNOWLEDGEMENTS

I would like to express my deep gratitude to Dr. Boonsub for his invaluable support throughout this research. His enthusiasm, patience, professionalism, combined with my efforts, have culminated in this doctoral report. I am profoundly thankful to my advisor, Dr. Boonsub.

I am grateful to my wife, Zixuan Zeng, for giving me her unwavering support in all aspects of life, study, and work. Her love has been my enduring motivation. I would like to thank my parents for giving me life and supporting me in exploring the world. I extend my heartfelt thanks to my parents-in-laws for providing me with the courage and support that I need. I am grateful to my grandparents for their care. I would like to thank my brothers Taotao Shen, Jun Chen, Wei Lu, Chenhao Wang, Zijun Tian, Xin Jiang and Dr. Dashi Li for their encouragement. I express my gratitude to my aunt Cai for her consistent help and advice. I am thankful to my leaders in Guangxi University of Finance and Economics Xing Cai, Ruohai Li, Guoxun Lai, Rongzhe Huang, Dongliang Ye, Xiuqian Chen, Shiyu Wu, and Jiani Chen for their immense support. I would like to thank Fan Yan, Zhenyu Zhao, Ruiwen Liao and the colleagues in school of Finance and Insurance, as well as Xun Liang, Shengri Wang, Yanping Wei and the colleagues in student affairs department. I am grateful to Prof. Dr. Wei Jiang from Shanghai Jiao Tong University for providing me with endless inspiration to explore the world. I wish to express my gratitude to my friends Yidan Zhang, Dr. Haimin Lin, and Dr. Zida Zhang for their assistance. I am thankful to Prof. Vatcharapol, Ajarn Thammanoon, Ajarn Melvin, Ajarn Nok, Ajarn. Puwanart, Ajarn Mada, Ajarn Athisarn, Ajarn Patchanee, Ajarn Sampan, Prof. Kullapa, Ajarn Somsak, and Ajarn Kwanniti for imparting invaluable knowledge to me. I am grateful to my friends Vittaya, Meay, and others in Thailand for their tremendous convenience and assistance, enabling me to have the perfect living and learning experience in Thailand. I express my gratitude to Naresuan University for providing me with a platform and resources for learning. I appreciate everyone who has blessed and helped me along the way. Furthermore, I would like to thank the dogs and lizards at NU for not eating me. Also, I am grateful to every durian and mangosteen that I ate.

These four years have been the most wonderful memories of my life. The completion of these four years does not mean the start of the end, nor the end of the beginning, but the launching moment of a new phase in my life as I step out of Naresuan University.

May the world a better place. Peace and love.

Yongtao Shen

TABLE OF CONTENTS

Page

ABSTRACT C

ACKNOWLEDGEMENTS ..... E

TABLE OF CONTENTS ..... G

LIST OF TABLE ..... J

LIST OF FIGURE ..... K

LIST OF ABBREVIATION ..... M

CHAPTER I INTRODUCTION 1

Overview 1

Background 3

Research questions 5

Research objectives 8

Scope of research 10

Framework of research 11

Research Significance and Contributions 11

Keywords 12

CHAPTER II LITERATURE REVIEW 13

Current International Trade Situation between Thailand and China 13

Supply chain and supply chain management 25

1. Supply chain 25

2. Supply chain management 27

3. Agricultural Supply Chain Management 29

Trade supply chain 32

Agricultural product trade supply chain 37

1. Research on Agricultural sustainability 37

2. Research on Thai agricultural supply chain 40

3. Research on Chinese agricultural supply chain....42
4. Relationships among the APTSC between Thailand and China....45
Financial supply chain....47
1. Financial agricultural supply chain....51
2. Participants in the APTFSC between Thailand and China....54
Summary....58
CHAPTER III RESEARCH METHODOLOGY....59
Workflow....59
Bibliometrics....61
1. Reviewing research with using CiteSpace....62
2. Database....63
3. Setting on CiteSpace....65
System Dynamic....65
1. System....65
2. System dynamic....67
3. Application of system dynamics with Vensim....68
1. The connection....71
2. Feedback loop and system....72
3. Casual loop setting....73
4. Variables setting....74
5. Flow map setting....79
CHAPTER IV VIEW OF AGRICULTURAL TRADE SUPPLY CHAIN....84
Countries analysis....84
1. Study in the ATSC....84
2. Study in the ATSC and Sustainability....89
Keywords analysis....91
1. Study in the ATSC....91
2. Study in the ATSC and Sustainability....96
Author analysis....100

1. Study in the ATSC 100
2. Study in the ATSC and Sustainability.....102
Reference analysis 103
1. Study in the ATSC 103
2. Study in the ATSC and Sustainability.....106
View of agricultural trade supply chain.....113
CHAPTER V SIMULATION OF THE APTFSC 114
General model.....114
Durian case 117
Rice case 119
Tapioca case.....119
Existing limitations or problems.....120
Improvement and innovation for the ATPFSC.....125
CHAPTER VI CONCLUSION AND RECOMMENDATIONS 127
The inspiration for establishing the ATSC 127
Lessons learned from simulations 129
Conclusion 133
Recommendation 134
Future research.....142
REFERENCES 144
BIOGRAPHY 172

LIST OF TABLE

Page

Table 1 Selected agricultural products with highest exported value from Thailand to China 18

Table 2 Comparison of each product 23

Table 3 Variables in material flow 75

Table 4 Variables in cash flow 78

Table 5 Values and expressions for the three main variables of the three agricultural products 83

Table 6 List of the ATSC literature published by each country with sort by centrality 87

Table 7 List of Top 15 Countries Ranked by Centrality and Frequency 90

Table 8 Top 10 keywords of the ATSC by sorting frequency and centrality 93

Table 9 List of Top 10 keywords of centrality and frequency 98

Table 10 Top 20 Keywords with the Strongest Citation Bursts 99

Table 11 Top 10 Cited authors of the ATSC 101

Table 12 Top 10 Document co-citation ranked by centrality and cited frequency 107

Table 13 Fourteen Clusters of Sustainability of Agriculture Trade Supply Chain 109

LIST OF FIGURE

Page

Figure 1 Trade-value Proportion of Thai products exported to China.....5
Figure 2 Framework of Research.....11
Figure 3 Thailand exports by country.....14
Figure 4 Merchandise exports of Thailand.....16
Figure 5 Thai Exported Agricultural Products (HS Code 1-24) to China with USD .19
Figure 6 Top 10 Value of Thailand agricultural products exported to China from 2019 to 2021.....20
Figure 7 Volume of Thai agricultural products export to China.....21
Figure 8 Thai exported agricultural products shares of value and volume.....22
Figure 9 Incoterm 2020.....34
Figure 10 Relationship among the APTSC in time.....46
Figure 11 Relationship among the APTSC in cost.....46
Figure 12 Process of the APTFSC with three flows.....57
Figure 13 Workflow.....60
Figure 14 Connection of system components.....71
Figure 15 Positive and negative feedback loops.....72
Figure 16 Casual loop of the APTFSC.....74
Figure 17 Flow diagram of material flow and cash flow in the APTFSC.....80
Figure 18 Distribution of research literature on the ATSC per country.....85
Figure 19 Map of countries or territories.....86
Figure 20 Tend of published papers about the ATSC during 2012 to 2021.....88
Figure 21 Network of Co-authors' countries.....90
Figure 22 Top 12 keywords with the strongest citation bursts in the ATSC.....95
Figure 23 Network of keywords co-occurring.....97
Figure 24 Network of co-author.....102
Figure 25 Map of reference analysis with clusters.....103

Figure 26 Document co-citation map 108
Figure 27 Cluster Map of Sustainability of Agriculture Trade Supply Chain 109
Figure 28 Cash flows of participants and total cash flow within setup model 115
Figure 29 Cash flows of participants and the total within changed delay model 116
Figure 30 Cash flows of participants and the total with extreme bad exchange rates 117
Figure 31 Cash flows of participants and the total in durian case 118
Figure 32 Cash flows of participants and the total in rice case 119
Figure 33 Cash flows of participants and the total in tapioca case 120

LIST OF ABBREVIATION

APTSC	=	Agricultural Product Trade Supply Chain
APTFSC	=	Agricultural Product Trade Financial Supply Chain
ATSC	=	Agricultural Trade Supply Chain
SC	=	Supply Chain
SCM	=	Supply Chain Management
ASC	=	Agricultural Supply Chain
FSC	=	Financial Supply Chain
FSCM	=	Financial Supply Chain Management
BRI	=	Belt and Road Initiative
ASEAN	=	Association of Southeast Asian Nations
ACFTA	=	ASEAN
HS CODE	=	Harmonized Commodity Description and Coding System
RCEP	=	Regional Comprehensive Economic Partnership
FOB	=	Free On Board
CFR	=	Cost and Freight
CIF	=	Cost, Insurance and Freight
DAP	=	Delivered at Place
DDP	=	Delivered Duty Paid
RMB	=	Renminbi (Chinese currency)
THB	=	Thai Baht (Thai currency)
SMEs	=	Small and Medium
SCF	=	Supply Chain Finance
TRQ	=	Tariff
IOT	=	Internet of Things
AI	=	Artificial Intelligence
VR	=	Virtual Reality
AR	=	Augmented Reality

CHAPTER I

INTRODUCTION

This chapter presents a brief overview of this research. It introduces the research plan, including the research questions and research subjects. By reading this chapter, you can gain an understanding of the two main research focuses of this study, namely the development of the Agricultural Trade Supply Chain view and the Financial Supply Chain Management simulation of Thailand-China agricultural trade.

Overview

Agriculture is widely treated as a base of national economy. The product provides the basic need for human, and its safety and stability are exposed to the constant attention of everyone. China and Thailand are ones of the most developed agricultural countries, and both are important trading economies in the world. Therefore, research considered agricultural product trade between these two countries is not only contributing value experience for other developing countries, but also leading a new direction of development in Asian agricultural product trade. Meanwhile, research on supply chain management (SCM) is continuing heating up in the field of optimization. This research will demystify the cash flow in the agricultural trade field through the SCM and explore the model of improving the performance of agricultural trade transactions through financial methods.

This research provides a view of agricultural product trading supply chain (TSC) by reviewing historical theories of trade and the SCM, and deeply discusses the financial application by collecting and identifying financial products and services in the chain. The contribution of this work is giving a new financial mode that steadies the agricultural product trading supply chain (APTSC) between Thailand and China, reduces the financial cost and improves the efficiency between both of biggest agricultural product exporter and importer.

International trade happened due to uneven distribution of natural resources, climatic conditions, growth rate, technology, and professional management (Mittal, & Sethi, 2018). Consumers have a strong desire to try agricultural products in different regions and climates, which has also led to the rise of agricultural trade. However, agricultural products are generally more susceptible to the influence of time than other products, and the value of agricultural products will disappear completely after the shelf life, which also poses great challenges to the transportation of agricultural products. Fortunately, today's technological proficiency and transportation maximize the value of agricultural products. Nevertheless, international trade remains highly vulnerable to national policies, natural disasters, and other factors, which influence the trade of agricultural product.

In order to enable agricultural products to be traded in a fast and safe way, so that consumers can get lower prices and better-quality agricultural products, and suppliers can get higher profits, this study will use relevant knowledge in the field of the SCM to explore ways to reduce costs and speed up time. Supply chain (SC) is more like a phenomenon in business activity with cooperation. It ranges from raw materials to product development, from consumption to recycling and reproduction. It includes consideration of cost, production, customer satisfaction, and social aspects. Academically, people call management in supply chain as supply chain management. This research analyzes the agricultural product trade between China and Thailand through the SCM, moreover, solves the problems and optimizes the process of agricultural trade through financial instruments.

In the study of SCM, researchers are most concerned about three flows, namely, material flow, information flow and financial flow. Financial flow lacks advancement comparing with other two flows which are developed with improving technology, perfecting transportation at present. When two or more partners are traded, there will always be a flow of money, which is what people call the financial flow. The flow is usually accompanied by the flow of materials and information, but the direction of the flow is often inconsistent. When flows (of finance, information, and materials) pass through multiple partners to form a chain, this study calls financial supply chain (FSC).

Background

Due to the geographical location and climate factors of Thailand, it has been always an important trading partner with China in agricultural products, especially in product relevant with rubber tree and edible fruit which occupy a big share of Thai export. Since cutting down of tariffs of fruit in import from countries in Association of Southeast Asian Nations (ASEAN) to China in 2006, the establishment of ASEAN-China free trade area in 2010, and the launching of Belt and Road Initiative (BRI), the value of fruit which imports from Thailand to China keeps increasing evidently. China has been a major exporter to Thailand. In 2019, Thailand's total exports to China amounted to 900 billion baht, second only to the United States. According to Thai customs statistical data, the most product export to China, rubber, and articles thereof, values 124 billion baht, which occupies 13.82% of total in 2019; another product relevant agriculture is edible fruit and nut, which exports worth 65-billion-baht unit to China per year and takes 7.22% of total in 2019. The number of trading between Thailand and China has been visible that is a huge prospect in the agricultural product business.

ASEAN countries has taken the third-largest economy in Asia, and on the way to be the fourth-largest economy in the world. In 2020, ASEAN countries contribute about 2.67 trillion dollars of trading commodities and there are 1.4 trillion dollars commodities for export. China has become the biggest trading partner by taking more than half of trading volume since 2020. ASEAN countries have exported a large number of agricultural products to China. The ASEAN-China Free Trade Area (ACFTA) is the region that covers ten member states of the Association of Southeast Asian Nations (ASEAN) and China. The ten countries include Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. ACFTA aims to integrate economic within the area. China acts an important role in the export of ASEAN countries, and the trade between ASEAN and China is complementarity (Devadason, 2010). Thailand is the one of five originators of ASEAN, and before the establishment of ACFTA, China and Thailand had signed the Goods Trade Agreement and the Agreement on Accelerated Tariff Elimination under the Early Harvest Scheme for Agricultural Products. Over the past decade, Thailand has taken highest advantage of the ACFTA among ASEAN countries with Thai exporters

exporting $17.63 million worth of goods at preferential export prices in 2018 (Rattana-amornpirom, 2020). From China-ASEAN Expo first convoked at Nanning, China in 2004, the significant achievement of reducing tariff in agricultural product can be visual. The Expo represents that it is not only business happened between China and ASEAN countries, but also other things like cultures deeply communicated. And economies among those countries are immeasurable because of cultural exchange. Nowadays, ASEAN widely cooperated with China and established multiple agreements with more economies starting from “10+1” (Cooperation between ASEAN and China), “10+3” (Cooperation among “10+1”, Japan, and Korea), 10+6 (Cooperation among “10+3”, Australia, New Zealand, and India). In 2020, 15 countries of “10+6” officially signed Regional Comprehensive Economic Partnership (RCEP), due to India quit in 2019. The RCEP claimed it is currently the widest, biggest, and most value cooperation in the world, and accelerates reducing tariff to 0% within 10 years among each participant.

According to Thai customs data in 2022, Figure 1 shows that agricultural products exported from Thailand to China in 2020 are 43% of all exports. This proportion increased to 50% by 2021. Therefore, the study of Thai agricultural product exports will be more representative.

Figure 1 Trade-value Proportion of Thai products exported to China

Source: Thai customs, elaborated by author

Research questions

Despite the large number of cooperation agreements between Thailand and China, there is still a lack of effective research to further optimize the agricultural trade supply chain. With the increasing trade volume, we are more interested in how to optimize the "production-trade-distribution" process to make the supply chain more stable and competitive. There are two main questions in this research. The author needs to answer or solve the questions and the sub-questions they derive step by step.

The first main question is that What is the current status and structure of the agricultural product trade supply chain between Thailand and China? To answer this question the research, the study needs clearly to draw a map that clearly shows the process from the original material in Thailand to the final agricultural product in China, which has to be collaboratively improved by multiple participants in serval areas such as farming suppliers, farmers, agricultural producers or manufacturers, commercial

financial institutes, exporters, trade brokers, governors or customs, freight forwarders, port managers, shippers, importer, distributors, retailers, and consumers. The most important point in this chain is defining the relationship and business activities among those participants. The author needs to review the existing literature relevant the APTSC and find out what are participants in the chain. Here is a list of the first main question and its relevant sub-questions with suggested answer below:

The first main question: What is the current status and structure of the agricultural product trade supply chain between Thailand and China?

Sub-questions:

1. What situation of agricultural product trade between Thailand and China?

A. The main agricultural products that Thailand exports to China with most representative

B. The role that government regulations, supply chain designers, and other participants play in the export of agricultural products from Thailand to China

C. Perspective of agricultural product trade between Thailand and China

2. What is the trade supply chain?

A. International trade and its theory (Literature review)

B. Supply chain and its relevant managemental concept (Literature review)

C. Concept of trade supply chain (Literature review)

D. Process of trade supply chain (Literature review)

3. What is the APTSC between Thailand and China?

A. View of the APTSC (Literature review and summary)

B. Process of the APTSC (Literature review and inspection by System Dynamics)

The second main question is that What are the issues and challenges faced in this supply chain, especially regarding financial flows? The key to answer this question needs to observe fully every part in the APTSC between Thailand and China. This research picks cost and time as the main factors to improve the chain being lower cost and faster time wasted.

The second main question: What are the issues and challenges faced in this supply chain, especially regarding financial flows?

1. What are the potential bottlenecks in the current supply chain?

A. Problems or limitations of material flow, information flow, and financial flow in the chain

B. Factors analysis of financial problems or limitations in the APTSC

2. What is the existing relationship between physical and financial flows in the supply chain?

A. System dynamics of the APTFSC

The third main question is that How can financial supply chain management approaches help optimize and improve the agricultural trade supply chain between Thailand and China? The key to answer this question needs to collect the financial products/services related to the APTSC. In this chain, financial products/services can be divided by payment, funding, and insurance. This research focus on payment and funding method.

The third main question: How can financial supply chain management approaches help optimize and improve the agricultural trade supply chain between Thailand and China, and what can we learn from that?

1. How do governors do for improvement?
   A. Tariff
   B. Subsidies
   C. Risk sharing mechanisms
2. How do supply chain designers do for improvement?
   A. Enhanced information sharing
   B. Aligning operations
3. How do financial institutes do for improvement?
   A. Increasing financing supports
   B. Developing agricultural futures and forward contracts for hedging
   C. Designing credit products tailored to the needs of agricultural enterprises or farmers

Research objectives

The research relies on a series of business in agricultural product trade between Thailand and China, therefore, defining and generalizing the activities as supply chain would be the first mission of the research. The objectives of research are:

1. To propose a view of agricultural trade supply chain.

The proposed study aims to provide a comprehensive understanding of the agricultural trade supply chain. To achieve this objective, the researchers plan to employ the methodology of bibliometrics, which involves analyzing and quantifying bibliographic data from relevant academic publications. One of the expected outcomes of this study is to gain insights into the various stages or divisions of the agricultural trade supply chain. Typically, the supply chain encompasses production, storage, transportation, trade, and marketing (or consumption) stages. By analyzing the literature in this field, the researchers aim to confirm and establish a clear understanding of the different components that make up the agricultural trade supply chain. In the course of the bibliometric analysis, the researchers also expect to identify patterns and trends in recent research contributions. Based on initial observations, it has been found that a significant proportion of recent studies on the agricultural trade supply chain have been authored by scholars from the United States and the United Kingdom. However, an interesting trend to note is the increasing interest and involvement of Chinese scholars in this research area. This suggests a growing concern and recognition of the importance of studying the agricultural trade supply chain by Chinese researchers. Another noteworthy finding from recent research in this field is the focus on environmental issues. With growing concerns about sustainability and the ecological impact of agriculture, researchers have increasingly directed their attention towards investigating and addressing environmental challenges within the agricultural trade supply chain. It can be expected that the bibliometric analysis will reveal a considerable body of literature that explores and discusses the environmental aspects of agricultural trade. Additionally, the researchers anticipate discovering a substantial number of studies that employ system dynamics when studying the agricultural trade supply chain. System dynamics is an analytical approach that allows for the modeling and simulation of complex systems, enabling researchers to understand the interconnections and feedback loops within the supply chain. This suggests that many researchers recognize

the value of system dynamics in comprehending the dynamics and complexities of the agricultural trade supply chain. In summary, the proposed study aims to provide a comprehensive view of the agricultural trade supply chain. Through the utilization of bibliometric analysis, the researchers expect to confirm the divisions within the supply chain, highlight the contributions of different countries' scholars, identify the emphasis on environmental concerns, and acknowledge the prevalence of system dynamics as an analytical tool within this research field.

2. To illustrate the financial flow problems and the limitation of the agricultural product trade supply chain.

To accomplish the objective, the research utilized simulation modeling with system dynamics. The simulation modeling involved developing a conceptual model of the agricultural trade financial supply chain between Thailand and China. It mapped out key variables and causal relationships related to material, information, and financial flows. The simulation model was implemented using Vensim software by coding model parameters and mathematical relationships. Simulations were run to analyze how changes in model variables impacted financial flows and participant cash flows over time. Different scenarios were tested by adjusting variables like delays, exchange rates, tariffs, demand, etc. Simulation outputs were compared for upstream farmers, trading manufacturers, and downstream distributors, revealing differences in cash flow patterns between supply chain stages. The model behavior was assessed under extreme conditions or external shocks, demonstrating financial flow vulnerabilities and imbalances. Key findings include downstream participants showed faster cash flow growth compared to upstream farmers, delays and disruptions caused increased upstream cash flow fluctuation, exchange rate changes had amplified negative upstream effects, tariffs disproportionately impacted the trading manufacturer's flows, and farmers' cash flows were most sensitive to external shocks. Overall, the simulation modeling provided a dynamic analysis of financial flows across the supply chain under various scenarios. By quantifying and visualizing cash flow patterns, the research illustrated the financial problems and limitations, especially for upstream participants.

3. To provide recommendations for improving the APTSC through financial supply chain management approaches.

The simulation modeling identified vulnerabilities and imbalances in financial flows, especially for upstream supply chain participants like farmers. These highlighted areas needing improvement. The research suggested specific financial products and services that could help manage risks and optimize financial flows at different stages. Examples include futures, forwards, options, trade finance tools, insurance products, and financial advisory services. The study recommended reducing tariffs and providing subsidies to alleviate cost pressures and risks for upstream participants. This helps address financial imbalances. Collaboration between partners was proposed to improve information flow, forecasting, and responsiveness for better financial planning. Recommendations emphasized the need for customized agricultural financial products to support supply chain roles. The recommendations incorporated modeling insights on root causes of financial vulnerabilities. The suggested interventions use financial tools and supply chain management approaches to directly address identified financial problems. Overall, the simulation modeling and focused recommendations fulfilled the objective of providing tangible proposals to improve financial flows. This demonstrated the value of financial supply chain management thinking.

Scope of research

Academically, scholars discussed “international supply chain”, “trade supply chain” and “international trade supply chain” would be considered as trading supply chain in this research, because supply chain itself involves the activity of trade. And at the beginning, this research focus on studying the business activities of supply chain in agricultural product trading between Thailand and China. Then, due to the final research contribution academically bias on finance, the financial flows in the chain would be the most important research object.

In order to make this research more practical and targeted, this research plan will focus on specific agricultural products. For the research more representative, this paper selected the two products with the largest amount and the largest number of Thai exports to China for research. At the same time, the selection of one of Thai most

famous agricultural products (the largest amount and quantity of Thai exports) as the research object is considered to ensure that this study can be value in practice.

Framework of research

The framework of this study, which shown as Figure 2, is to investigate the agricultural product trading financial supply chain (APTFSC) from Thailand to China. The APTFSC is divided into three aspects: agriculture, trade, and finance. Through literature review and bibliometrics analysis, the agricultural trade supply chain is proposed. Then, by system dynamics study, representatively exported Thai agricultural products are analyzed, with focusing on cash flow in financial supply chain management. Finally, conclusions and recommendations are drawn.

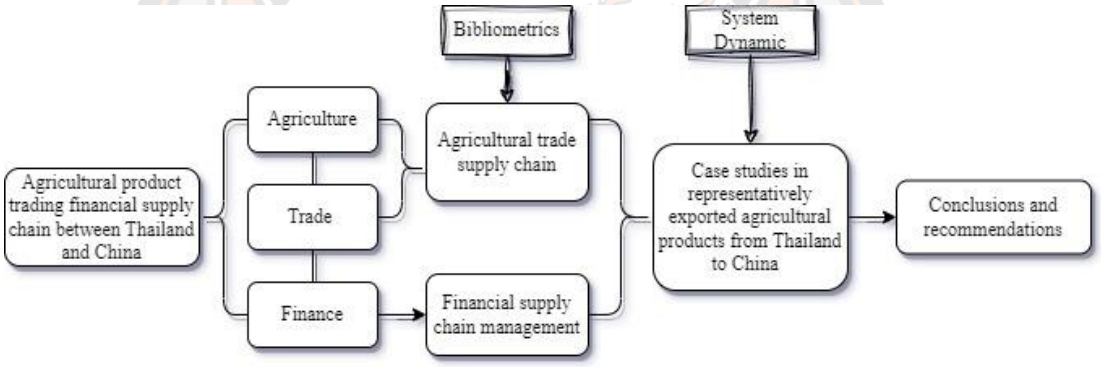


Figure 2 Framework of Research

Research Significance and Contributions

At first, this research contributes to build an APTSC between Thailand and China, which still be blank in these areas. Author draws the APTSC map that clearly represents a general process of agricultural product business. The map tries to provide a comprehensive process, and through the observing in the details of cost and time, defines the key factor in the chain and improves it to be better, cheaper, and faster.

Secondly, the research concerns the effect in multi-dimension which includes issues of international trade, finance, and management. International trade theory has been discussed in a decade, the theory like factor endowment theory still be in

developing, and this research can provide new evidence or factor for enriching the theory as like supply chain relevant factor. World Trade Organization (WTO) has been established about 70 years. Recently some scholars argued about the contracts under the WTO cannot satisfy the requirement of international trade in the world. An issue about supply chain orientation has been researched that the WTO needs to be fulfilled by supply chain management in the regulations(Baldwin, 2012). The author believes this research can find out more evidence of the thinking and contributes to the WTO unexpectedly.

Finally, finance has been researched by many years. The knowledge combined supply chain and finance is giving more possibility to funding for more enterprises. However, current applications of that are rarely used in the practice. This research reviews the financial products/services which combines the knowledge of supply chain management, checks the practicability, and improves the performance.

Keywords

Supply chain management; Agricultural product; Trade; Finance; Bibliometrics; System Dynamic.

CHAPTER II

LITERATURE REVIEW

This chapter presents the literature reviewed by the author for conducting research. The review of supply chain management, agricultural supply chain management, and trade supply chain help in establishing the ATSC concept in this study. The review of the current status of Thailand-China trade, financial supply chain, and participants in Thailand-China APTSC help in building the simulation model for FSCM in Thailand-China agricultural trade.

Current International Trade Situation between Thailand and China

With the recent trade dispute between China and the Unit State of America, global economy has been hit hard. According to the regression model, some researchers have proved that the Sino-US trade war has had an unprecedented impact on Thailand's economy. Since China and the United States are both major exporters to Thailand, the slowdown has affected the prices of the mass goods, reducing Thailand's exports (Nidhiprabha, 2019).

Although the trade war is not recognized, scholars still need to study the impact of the Sino-US trade war. By studying tariff-related databases, some scholars have found that Chinese imports and exports to the U.S. fell by 52.3 and 49.3 after the first phase of the U.S.-China trade war came into effect. In addition, the study found that trade between China and the United States is being transferred to their major trading partners, including many Asian countries. The study also suggests that without a reduction in the first phase of tariffs, the impact of the U.S.-China trade war will continue to be magnified. According to Figure 3, Chinese exports to Thailand are the most affecting relative to other countries in the world (Li et al., 2020).

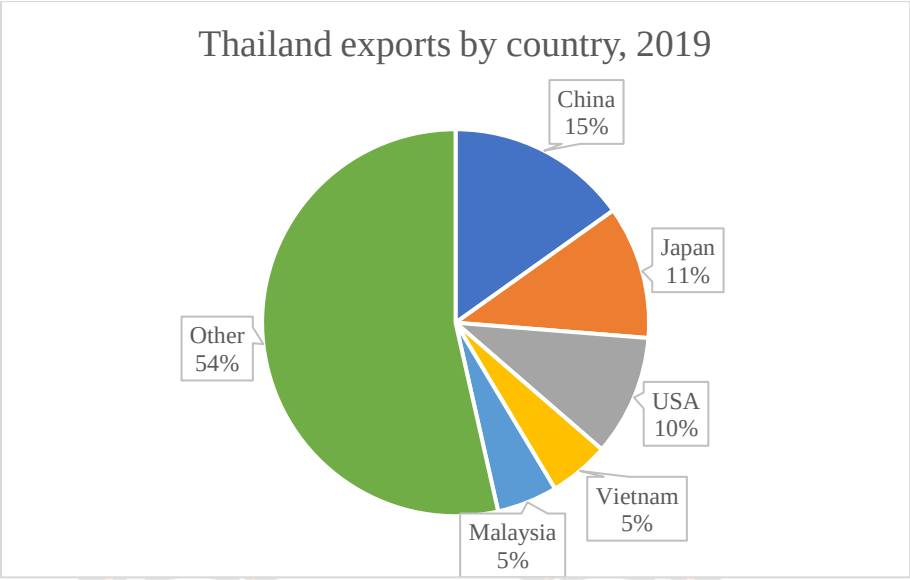


Figure 3 Thailand exports by country

Source: COMTRADE, 2017

After analyzing the consequences of the Sino-US trade war, some scholars say it has had a negative impact on the global economy. Studies have explained from causal analysis the tendency of China and the United States to dump large quantities of goods and services into Thailand as a result of trade wars. China and the United States are Thai largest trading partners. In 2017, Thai exports to China amounted to US$2.638 billion, or 15 percent of the total. It is clear that trade between Thailand and China affects Thai economy to a great extent (Onyusheva et al., 2020).

In these years, the BRI initiative has attracted more and more national attention. After reviewing the BRI strategic framework, some scholars pointed out that the strategy is in Thailand's interest. Thailand should use this cooperation to expand cooperation with China in various fields more actively (Punyaratabandhu, & Swaspitchayaskun, 2018). Due to the cooperation like the BRI, ASEAN-China free trade agreement, and the LMC, agricultural trade in China has been energetically improved. A research based on gravity model shows Chinese bilateral agricultural trade flow between China and its main trading partners, and gives annual average market exchange rate and regional integration/strategic economic partnership status are the

important factors of Chinses bilateral agricultural trade flow (Muganyi, & Chen, 2016). For example, Thai jasmine rice, as a famous main agricultural export product, has been concerned by researchers. A research, through trade statistical data and the specific statistical data related to Thai jasmine rice, shows the trade volume is reducing with rice competitiveness weakening as a result of exchange rate worsened (Chuaykerd et al., 2020).

More cooperation causes more openness in trade. Reviewing the historical data about value of cargos trade between, scholars found that the exchange rate between Renminbi (RMB) and Thai Baht (THB), the level of the trade facilitation, the trade policy, and the relevant factors significantly affect the trade between Thailand and China. In addition, notably, a review of World Bank data shows that the merchandise export of Thailand (Figure 4) has changed in line with the cooperation events between 2009 and 2019. In 2007, China and Thailand signed agreement about China-Thailand Joint Action Plan for Strategic Cooperation. In the end of 2011, China and Thailand signed an operation agreement about Strategic Framework for the New Decade of Economic Cooperation in the Greater Mekong Subregion (2012-2022). In 2015, a report about how Thai public treat Chinese mentioned that 41.1 percent of Thais think the U.S. is more important than China, another 40.2 think China-Thai trade is bad for Thailand, and even 32.7 Thais think China poses a threat to Thailand. For foreign products, Thais are more willing to accept European, American and Japanese and Korean products, while the evaluation of Chinese products is mainly cheap and of poor quality.

Figure 4 Merchandise exports of Thailand

Source: World Bank, 2020

Exchange rate directly affect the trade between Thailand and China. Scholars found that Chinese currency (RMB) is influential trading contributory factor when the relevant trade is surplus, and with the exchange rate of RMB revalued, the impact factors on the surpluses are elasticity (Whalley & Wang, 2011). Due to the exchange rate is accurately unpredictable, this research also needs to concern the effect of exchange rate and the export business activities to China. Scholars compared the COMTRADE data about the trade between ASEAN countries and China from 1994 to 2008, exchange rate volatility negatively affect high technology and medium technology export, which means more sophisticated technology creates higher risk in monetary volatility (Hooy et al., 2016). Some researchers showed that a long term relationship between exchange rate and exports still exists in Thailand from 1979 to 2010 (Chaudhary et al., 2016), and also the uncertain exchange rate effects short-run export has been estimated by linear models (Bahmani-Oskooee & Kanitpong, 2019b). Moreover, although the asymmetric effects of changed exchange rate exists in the trade between Thailand and China (Bahmani-Oskooee, & Kanitpong, 2018), different industries show different financial status in uncertainly diversified exchange rate

(Bahmani-Oskooee, & Kanitpong, 2019a).

In conclusion, reviewing the current research about international trade between Thailand and China, the author found there is significantly positive impact between Thailand-China bilateral cooperation and Thai merchandise trade, and Thailand-China bilateral cooperation provides bilateral trade cooperation between China and Thailand has greatly stimulated trade between China and Thailand, and many studies have shown the impact of the exchange rates of the RMB and the THB on trade. Therefore, this study will focus on bilateral trade between China and Thailand, and observe the impact of these two factors on financial supply chain management.

According to definition of the WTO, agricultural products should include products of 01 to 24 and some other six-digit codes in the HS CODE. In fact, many studies use HS CODE 01 to 24 as agricultural products for research, for example, a study about the impact of the ASEAN-India Free Trade Agreement on agricultural trade by defining agricultural products as HS CODE 01 to 24 (Jagdambe & Kannan, 2020). Since most of the trade between China and Thailand is within the range of 01 to 24, the author extracted goods exported from Thailand to China within HS CODE 01 to 24 as a reference.

The table 1 shows agricultural products selected from HS CODE 01 to 24, which account for a large proportion of agricultural products exported from Thailand to China. The table also shows the descriptions and representative products corresponding to the 6-digit HS CODE. As can be seen from the table, HS CODEs starting with 08 appear the most frequently. In the 2-digit HS CODE, 08 represents edible fruits and nuts. This indicates that most of the types of agricultural products exported from Thailand to China are related to fruits and nuts. Among them, durian and mangosteens are the most prominent.

Table 1 Selected agricultural products with highest exported value from Thailand to China

HS CODE	Description	Representative
[071410]	Vegetable roots and tubers; manioc (cassava), with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets	Vegetables
[081060]	Fruit, edible; durians, fresh	Durians
[110814]	Starch; manioc (cassava)	Tapioca
[100630]	Cereals; rice, semi-milled or wholly milled, whether or not polished or glazed	Rice
[081090]	Fruit, edible; fruits n.e.c. in heading no. 0801 to 0810, fresh	Fresh tamarinds
[080450]	Fruit, edible; guavas, mangoes and mangosteens, fresh or dried	Mangosteens
[081340]	Fruit, edible; fruit n.e.c. in heading no. 0812, dried	Other fruit
[210690]	Food preparations; n.e.c. in item no. 2106.10	Food preparations
[020714]	Meat and edible offal; of fowls of the species Gallus domesticus, cuts and offal, frozen	Meat
[081190]	Fruit, edible; fruit and nuts n.e.c. in heading no. 0811, uncooked or cooked, frozen whether or not containing added sugar or other sweetening matter	Frozen fruit and nuts
[170199]	Sugars; sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter	Sugars

The figure 5 shows the value of agricultural products exported from Thailand to China from 2010 to 2022 corresponding to the HS CODE in the above table. From 2010 to 2022, Thailand's agricultural product exports to China have grown overall. The most prominent products are 071410, 110814 and 081060, namely vegetables, cassava starch and durian. Vegetables had been Thailand's main agricultural export to China until before 2017 and reached the highest export amount in history in 2014-2015, exceeding US$15 billion. But from 2016, Thailand's vegetable exports to China have continued to decline until 2019. Although from 2020, the value of vegetables exported

from Thailand to China has increased again and exceeded US$15 billion, it is no longer the main exported agricultural product. The highlighted orange line in the graph represents the value of Thai durian exports to China. It is evident that durian experienced rapid growth after 2018. In fact, in 2020, its value exceeded the total value of all other agricultural products excluding the top ten. In 2021, durian reached its peak in terms of growth, and although there was a decline in 2022, it still remained above 3 billion US dollars. Apart from that, we can observe that the silver line representing Tapioca, while not reaching the same level of value as the two aforementioned agricultural products, exhibits a significant value higher than the other 7 agricultural products.

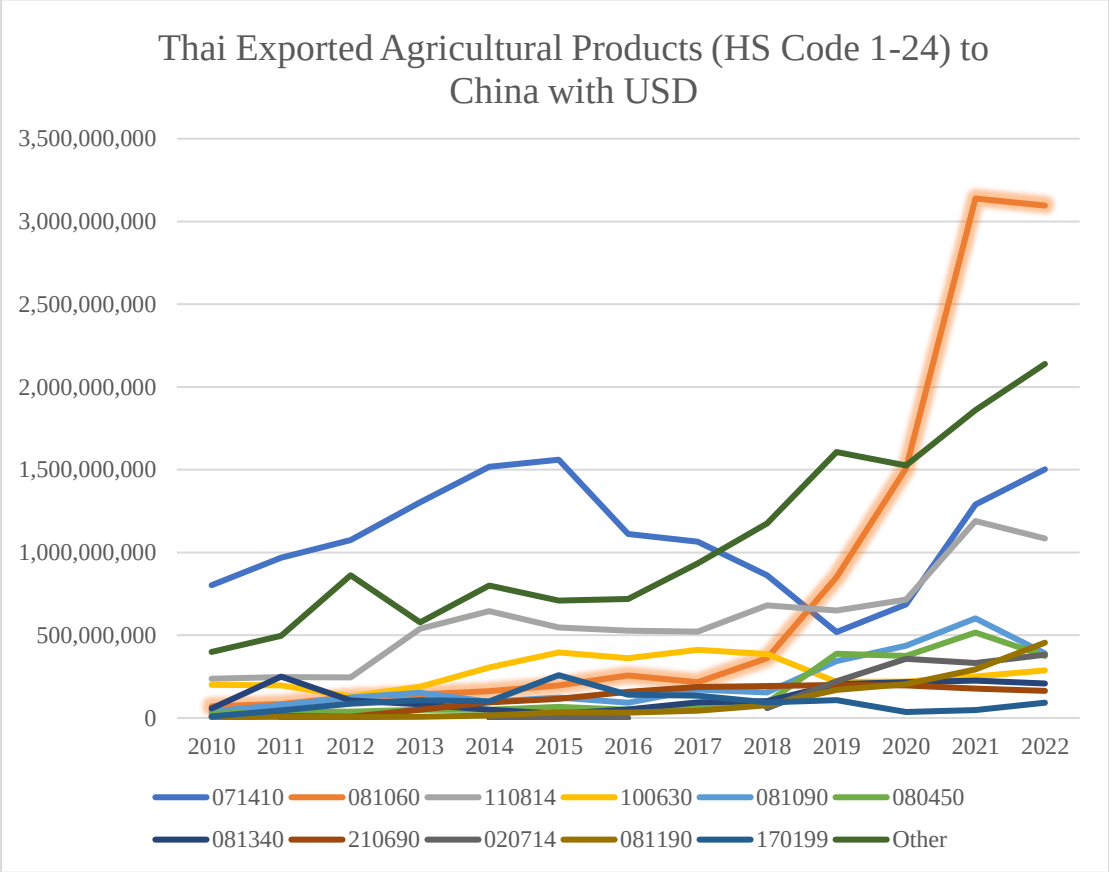


Figure 5 Thai Exported Agricultural Products (HS Code 1-24) to China with USD

According to top 10 value data of the exported agricultural products that from Thailand to China between 2019 and 2021, as the Figure 6 shown, Durians takes 1694.2 million USD and 3399.74 million USD which is the most value in 2020 and 2021. The following most value of Thailand-to-China agricultural product is Tapioca products which was the second most value from 2019 to 2021. The third most value is rubber which is also eye-catching due to it being the most value one in 2019. The following most value agricultural products are Longans, Mangosteens, Rice, Vegetables, Vegetable seeds and Beans.

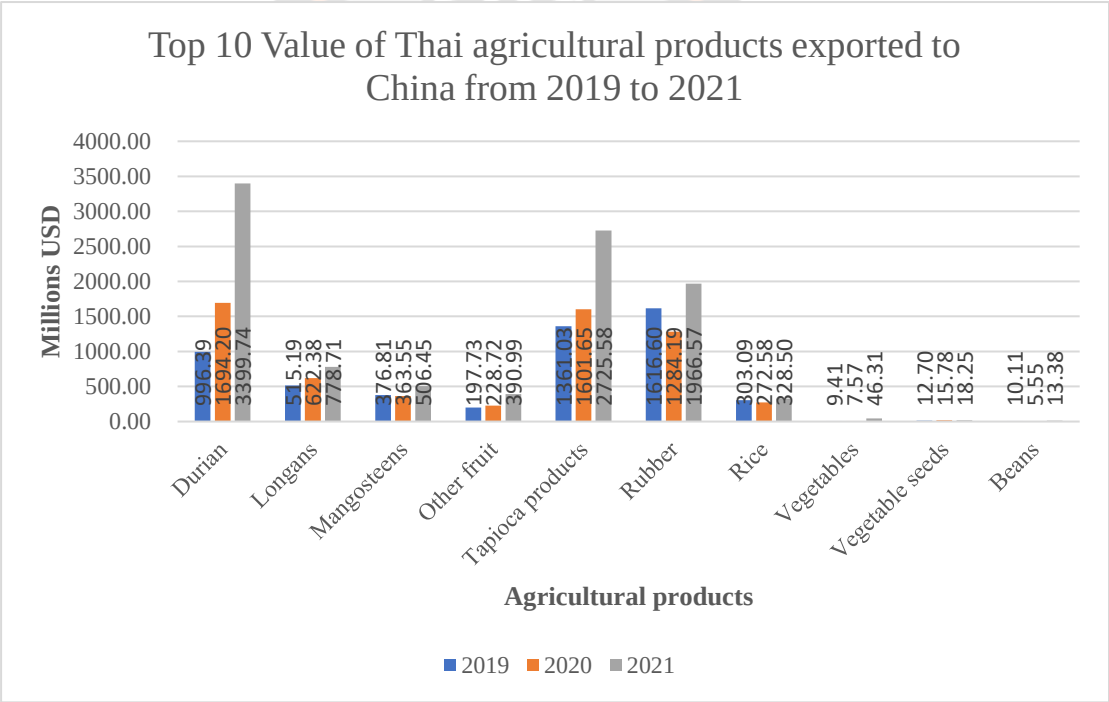


Figure 6 Top 10 Value of Thailand agricultural products exported to China from 2019 to 2021

Source: Ministry of Commerce, elaborated by author

According to volume data of exported agricultural products that from Thailand to China between 2019 and 2021, as the Figure 7 shown, Tapioca products takes obviously most volume from 2019 to 2021. The following in top 5 are Rubber, Fruit, Rice, and Oil seed.

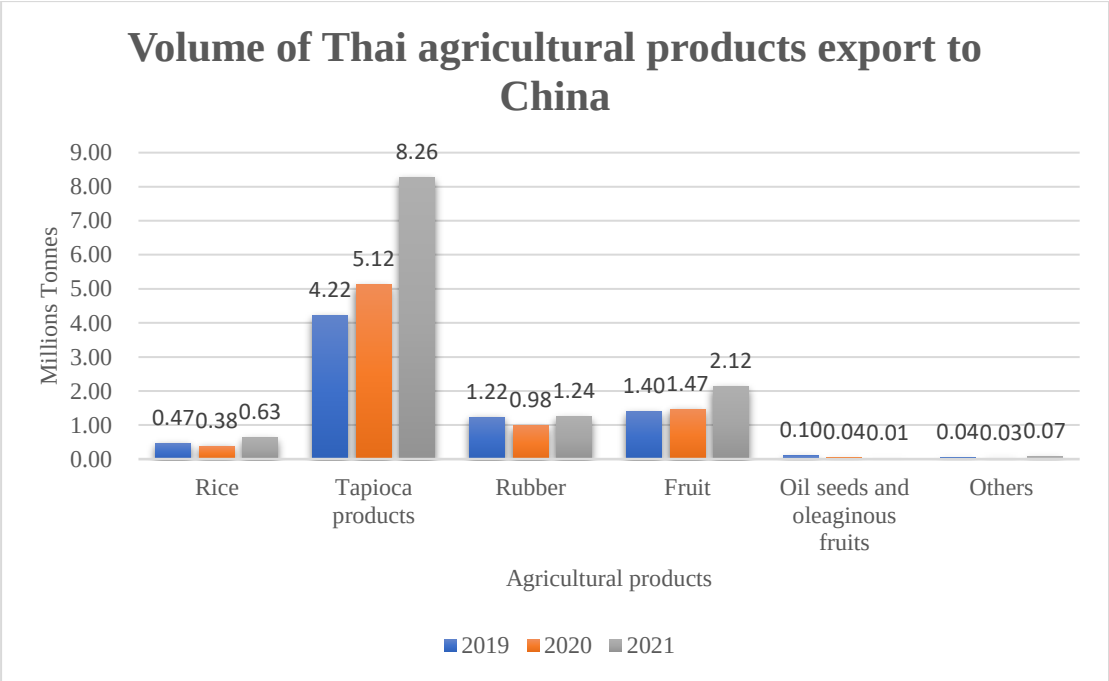


Figure 7 Volume of Thai agricultural products export to China

Source: Ministry of Commerce, elaborated by author

In addition, in order to cover Thai representative agricultural products in this research, the most popular Thai agricultural product should be considered for studying if the research would improve its competitiveness in Thailand-to-China agricultural products. As shown in the Figure 8, rice accounts for the vast majority of Thai agricultural exported products in terms of value and quantity with 25% and 38%.

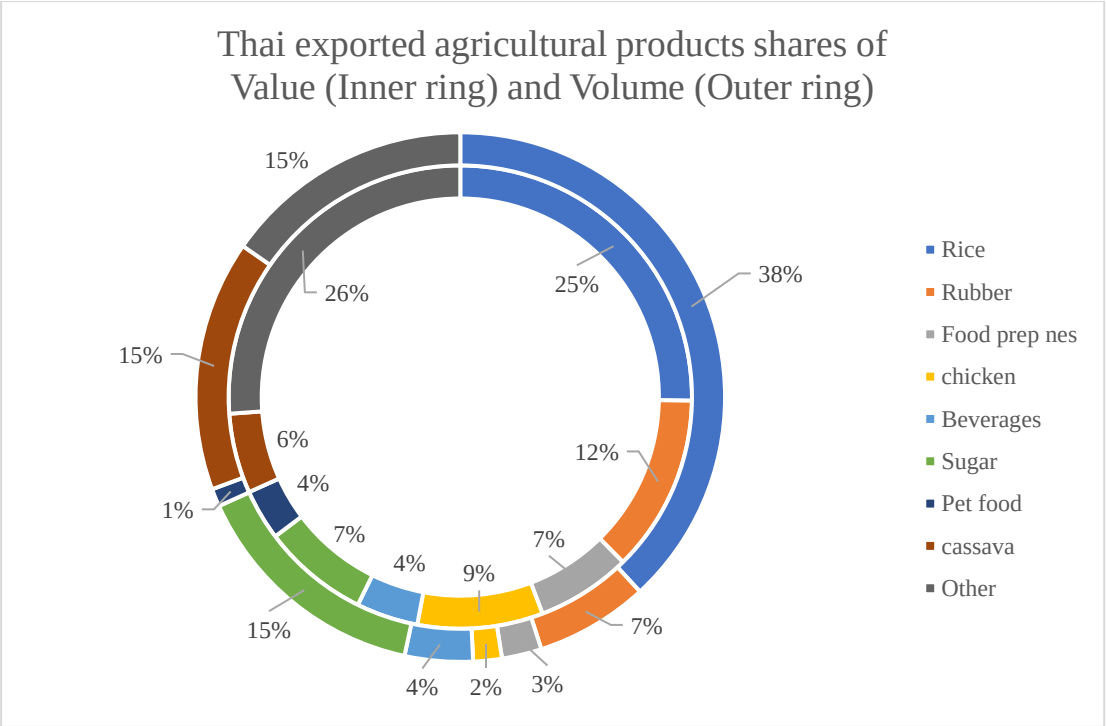


Figure 8 Thai exported agricultural products shares of value and volume

China and Thailand have a longstanding history of economic activities, with agricultural products being the primary commodities traded from Thailand to China. In 2021, agricultural products accounted for half of Thailand's total exports to China, up from 43% in 2020. The most significant agricultural products in this trade are durian and tapioca, which have the highest value and volume. Thai rice and rubber are also popular in the Chinese import market. Durian, in particular, has emerged as a notable agricultural product in Thailand, with expanding plantation areas and a growing durian industry over the past decade (Win, 2017). Consequently, production and exports of durian have increased. The established process for exporting Thai durian to China involves various actors, including Thai durian orchardists, middlemen, processors, exporters, Chinese importers, distributors, and end customers. As Thai durians gain popularity in China, Chinese entrepreneurs have begun participating in the logistics, sorting, and packaging aspects of the durian trade between the two countries (Tantrakoonsab, & Tantrakoonsab, 2021).

Durian, rice, and tapioca differ in several aspects when it comes to production, storage, transportation, trade, and marketing from Thailand to China. Table shows some key differences.

Table 2 Comparison of each product

Name	Durian	Tapioca	Rice
2 Digital HS Code and Classification	08 Fruit	11 prepared starch products	10 Cereals
Characteristic of production	Durian is a tropical fruit produced mainly in Southeast Asia, including Thailand. It requires specific climatic conditions and is grown on durian plantations. The fruit trees take several years to mature before yielding fruits.	Tapioca is derived from the cassava plant, which is widely grown in Thailand. Cassava roots are harvested and processed to extract tapioca starch.	Rice is a staple crop in Thailand and is cultivated in rice paddies. It requires flooded fields for cultivation and is a significant part of the agricultural industry in Thailand.
Characteristic of storge	Durian is a highly perishable fruit due to its strong aroma and short shelf life. It needs to be stored in cool and ventilated conditions to preserve its quality.	Tapioca starch is a stable product that can be stored in dry and cool conditions for extended periods without significant degradation.	Rice can be stored in dry conditions with low moisture levels to prevent spoilage and insect infestation. Proper storage facilities, such as silos or warehouses, are used.

Name	Durian	Tapioca	Rice
Characteristic of transportation	Due to its perishability and strong odor, durian requires careful handling during transportation. It is usually transported by air freight or refrigerated trucks to maintain its quality.	Tapioca, in the form of starch or processed products, can be transported in bulk or packaged forms. It can be shipped via containers or bulk vessels, depending on the volume and market demand.	Rice can be transported in bulk through various means, including trucks, trains, and ships. The transportation method primarily depends on the quantity and destination.
Characteristic of trade	Thailand is a leading exporter of durian, and China is one of the largest importers. The trade involves meeting quality standards, negotiating import/export regulations, and complying with food safety requirements.	Tapioca starch and processed tapioca products are exported by Thailand to China. The trade includes ensuring compliance with import regulations, certification, and quality control standards.	Thailand is one of the world's major rice exporting countries. China is a significant importer of Thai rice, and the trade involves negotiating quality standards, pricing, and trade agreements.
Characteristic of marketing	Durian is marketed based on its unique taste, aroma, and texture. Specialized marketing efforts focus on promoting the fruit's attributes, organizing durian-related events, and connecting with	Tapioca marketing may involve promoting tapioca starch as a versatile ingredient in various industries such as food, pharmaceuticals, and manufacturing. It can include engaging with distributors, manufacturers, and promoting the benefits	Rice marketing often involves emphasizing quality, grain varieties, and packaging. It includes branding efforts, participation in trade fairs, engaging with wholesalers, retailers, and

Name	Durian	Tapioca	Rice
	consumers through various channels.	and applications of tapioca starch.	exploring e-commerce platforms.

It's important to note that these points provide a general overview, and specific practices may vary depending on various factors within the industry.

By observing such studies, the APTSC can be seen as a three-stage supply chain, composed of farmers, trading manufacturers, and distributors. farmers are responsible for harvesting the agricultural products, while trading manufacturers handle the procurement and processing of the fruit. Finally, distributors receive the durians and sell them to the market.

Supply chain and supply chain management

1. Supply chain

Supply chain, also called demand chain and industrial chain in public. The word, supply, defined as “the things such as food, medicines, fuel, etc. that are needed by a group of people” in Oxford English Dictionary. Chain literally means a serial assembly of connected pieces links each other. Supply chain visually shows a relationship in a system of organization, people, activity, information, and resources. The movement normally contains transforming natural resources, raw materials, and components into finished products delivered to customers (Kozlenkova et al., 2015). Scholar defines a supply chain as a network consisting of upstream and downstream organizational entities involved in the process and activities of delivering products or services to end consumers, with a focus on customer demand and the goal of improving quality and efficiency. The American Production and Inventory Control Society (APICS) considers the supply chain as the entire process, from raw materials to finished products, involving the interconnectedness of buying and selling enterprises, including all functions within and outside an organization that contribute to product value creation and customer service.

The word, Supply Chain, is not only meaning supply but also covering demand. The chain is a complex and dynamic supply and demand network (Wieland, & Wallenburg, 2011). Meanwhile, people barely talk supply chain without industry because scholars have to deep into the relationship between main research object (typically core enterprise) and relevant partners (typically suppliers or buyers), those participants related to vertical integration and obligational contracts are parts of the certain industry(Ellram, 1991). According to the National Standard Logistics Terminology (GB/T 18354-2006), a supply chain is defined as a network structure formed during the production and flow process, involving the provision of products or services to end users. In the "Guiding Opinions on Actively Promoting Supply Chain Innovation and Application" issued by the General Office of the State Council, the supply chain refers to an organizational form that is customer-oriented, aims to improve quality and efficiency, integrates resources as means, and achieves highly efficient coordination throughout the entire process of product design, procurement, production, sales, and services. It is characterized by innovation, collaboration, win-win, openness, and sustainability. Initially, supply chain was considered an internal process of manufacturing companies, but it later expanded to encompass the external environment of the supply chain, which facilitated its rapid development. The modern view of the supply chain emphasizes the network relationships centered around the core enterprise. The supply chain encompasses not only the material, information, and financial flows but also the value-added chain.

Academically, especially in managemental research, some believe supply chain should be described by purchasing and supply activities of core enterprises, transportation and logistics functions of merchants and retailers, and value-adding activities from the raw materials suppliers to the end-users, and also reverse (Tan, 2001). Besides, the different subject works of literature in this area has been divided into purchasing and supply, logistics and transportation, marketing, organizational/industrial behavior, transaction cost economics and contract view, contingency, institutional sociology, system engineering, network, best practices, strategic management, economic development (Croom et al., 2000). In addition, some scholars think systematic and strategic coordination of traditional business functions within specific companies and supply chains to improve the long-term performance of

individual companies and the entire supply chain (Mentzer et al., 2001). Moreover, supply Chain Management is a way to effectively integrate suppliers, manufacturers, warehouses, and stores to produce and distribute goods at the right quantity, in the right place, and at the right time, minimizing system-wide costs while meeting service levels (Love et al., 2004).

In conclusion, the supply chain is more like a phenomenon in business activity with cooperation, and it ranges from raw materials to product development from consumption to recycling and reproduction, it also includes consideration of cost, production, customer satisfaction, and social aspects (Charvet et al., 2008; Gammelgaard, 2004; Svensson, 2004). In addition, supply chain has been studied in many areas, but mostly it reflects the problems in management (Christopher, 1999).

2. Supply chain management

The management in supply chain can be described by a systemic strategic coordination between traditional business and the business relevant supply chain for long term performance (Min et al., 2019). Researcher and practitioners were struggled between operational efficiency (supply) and differentiation (demand) before a new concept of supply and demand integration, and the concept coordinates operation in the relevant production with consumer value (Stank et al., 2012). The area of traditional supply chain management always has been considered by several interdisciplinary studies, such as logistics, management, marketing, and information technology (Giunipero et al., 2008). Logistics has been included by supply chain management and becoming the most important improved factor in material flow (Yu et al., 2016). Researchers analyzed the relationship between manufacturers and retailers by game theory, and contributed literatures in the aera of marketing and supply chain (Gao et al., 2016). With the development of information technology, information and digital divides represented two overlapping research areas (Yu, 2006).

According to the Council of Supply Chain Management Professionals (CSCMP) which is a global influential organization in logistics and supply chain industry, the ideal result in supply chain management are boosting customer service (Delivering the correct product of correct amount at correct place on correct time and supporting a quick post-sale service), reducing operating cost (Decreasing purchasing cost, production cost, and total supply chain cost), and improve financial position

(Decreasing fixed assets and increasing profit leverage and cash flow).

Scholars researched supply chain management and conceptualized it as a simple management of transport or flow of goods and services which are storage, shelf life, analysis of harvested product, and logistics, etc. (Mr & Mr, 2016). Some defines the management as an integration of key commercial processes which start with original suppliers and end with users, and the each section that provides products, services, and information adds value on that (Desai & Rai, 2016). Academically, supply chain management has been discussed as a task of integrating organizational units with the chain and coordinating materials, information, and financial flows to satisfy consumer demands and improve the competitiveness (Dias & Ierapetritou, 2017) in various industries (Oelze et al., 2018). Some believe supply chain is a system of organizations, people, activities, information, and resources provided from supplier to consumer in the form of products or services. Precisely, transformation of natural resources, raw materials, and components into a final commodity have been driven by the business activities from companies to consumers, and the relationship of upstream and downstream linkages is treated as the network of organizations (Kain, & Verma, 2018). The most attention that scholars is usually how the participants in the chain treat each relationship, and the key point of supply chain management is to persuade those companies to coordinate and collaborate with each other who can be suppliers, intermediaries, third-party service providers, and consumers (Ellram, & Murfield, 2019). The final goal of supply chain management is to satisfy customer requirements as efficiently as possible, and the way on reaching it is the process which plans, implement, and control the operations of supply chain on purpose (Martins & Pato, 2019).

In conclusion, this part argues what supply chain management is, how people treat it, what does it do for business and research. The knowledge of supply chain management assists the APTSC on the space for improving and help the research to establish a system of organizations, people, activities, information, and resources with cooperation. Also, the three flows mentioned below are vital factors to analyze processes in the chain.

3. Agricultural Supply Chain Management

The introduction of supply chain thinking into the agricultural field began in the early 1990s. Since the concept of food supply chain has been firstly proposed in 1996, supply chain management has drawn significant attention from the academic and business communities. Other scholars from domestic and international sources have also proposed various expressions related to agricultural supply chains, including agriculture chain, supply chain related to agriculture, agriculture supply chain, agriculture food supply chain, and food and agriculture supply chain. A scholar views the agricultural supply chain as a vertically integrated chain that includes not only agricultural production but also related processes such as processing and marketing (Downey, 1996). Also a scholar defines the agricultural supply chain as a structure formed by a series of interrelated products, information, and services from seed to the table (Wysocki, 2000). Hua (2004) points out that the agricultural supply chain consists of the supply of production materials, agricultural production, processing, distribution, retail, and their organizational entities, which respectively refer to seed (feed) suppliers, farmers (production enterprises), processing factories, distribution enterprises, retailers, and wholesalers. Also, another Chinese scholar believes that the agricultural supply chain involves the integration of logistics, fund flows, and information flows related to all the processes from the purchase of agricultural production materials and seeds to the delivery of agricultural products to end consumers, connecting input providers, farmers, agricultural product manufacturers, distributors, and wholesale and retail enterprises into an interconnected structure with overall functionality. Some scholars also propose a broader definition of the agricultural supply chain, including both the physical product supply chain and the service supply chain, and describe the logistics, information flows, and fund flows within the agricultural supply chain. In addition, on the relationship between the agricultural supply chain and the industrial chain, asserting that the supply chain and the industrial chain are different expressions of the same entity in different environments. In macro-level studies, the production, processing, and distribution of agricultural products form an integrated industrial chain known as the agricultural industrial chain. In micro-level analysis, the interconnected upstream, midstream, and downstream activities in the management of agricultural products are referred to as the agricultural supply chain, and agricultural industrialization represents the complete

process of an agricultural product supply chain.

Supply chain management is defined as the art of managing the flow of materials, resources, and products from producers to consumers. It encompasses the coordination and development of various stages in the supply chain, including manufacturers, distributors, and retailers. The goal of supply chain management can be understood as “6R”, which are to deliver the right product, at the right time, in the right quantity, with the right quality and right status, to the right place, while minimizing overall costs. Compared to industrial supply chains, agricultural supply chains are more complex due to the volatility of agricultural production, the perishable nature of fresh agricultural products, and high distribution costs. Agricultural supply chain management focuses on optimizing the efficiency of the entire process, from production and procurement to meeting customer demands, by managing logistics, financial flows, and information flows. The concept of agricultural supply chains in this article refers broadly to all supply chains associated with the agricultural industry, including grain, meat, dairy, processed agricultural products, as well as non-agricultural products such as pesticides, fertilizers, feed, and agricultural machinery.

The study of agricultural supply chain management theory has evolved in conjunction with logistics theory research, including contract theory (Zhang, & Aramyan, 2009) and complex network theory (Gang et al., 2015).

Contract theory, rooted in multi-stage inventory theory, has become a research focus for coordinating supply chains. Its application in supply chain coordination management aims to achieve optimal outcomes for both individual supply chain members and the entire supply chain system. According to contract theory, various entities in the agricultural supply chain cooperate through contracts, which play a crucial role in ensuring supply chain management. The coordination mechanism in supply chain management is essentially an incentive-based institutional constraint. It guides and constrains the independent behaviors of supply chain participants, fostering cooperative interactions that enhance the efficiency and benefits of the entire supply chain. Contract theory has undergone three stages of development: classical contract theory, neo-classical contract theory, and modern contract theory. Classical and neo-classical contract theories uphold the completeness of contracts, which accurately describe all future possible states related to transactions, as well as the rights and

responsibilities of contract parties under each circumstance. Modern contract theory recognizes the incompleteness of contracts due to factors such as bounded rationality, information asymmetry, and environmental complexity, which cannot be fully compensated through third-party mechanisms. The concept of supply chain contracts was first proposed by Pasternack in 1985, and subsequent research explored various types of supply chain contracts, such as wholesale price contracts, quantity discount contracts, buyback return profit-sharing contracts, feedback and penalty contracts, and price subsidy contracts.

Complex network theory, a research hotspot in multiple disciplines, was initially applied in fields such as mathematics, physics, and computer information. It gradually expanded to areas like supply chain and logistics management, providing a new research perspective for agricultural supply chain management. Complex networks are complex systems with large-scale topology, intricate structures, and diverse nodes formed by connections between numerous individuals, exhibiting dynamic behaviors. From the standpoint of complex network theory, nodes represent entities in the supply chain, while edges represent various relationships such as cooperation and competition among these entities, facilitating the flow of logistics, information, and financial resources in the supply chain. With the increasing globalization of trade, agricultural products involved in global trade are produced by numerous enterprises located in different countries. Through global supply chains, thousands of production nodes are connected and exchanged. Agricultural supply chains have evolved from traditional linear structures to complex network structures, featuring multiple core enterprises, product diversification, and diverse entities pursuing their individual interests. Through business interactions and collaborative efforts, multiple interacting supply chains are formed. Complex network theory is currently widely applied in the study of complex characteristics, network attributes, modeling techniques, and behavioral phenomena of supply chain networks. For instance, research on supply chain management identified the bullwhip effect and its relation to the topological properties of supply chain networks (Helbing et al., 2006). It suggests that a well-structured supply chain can mitigate the bullwhip effect while increasing stability and resilience. In China, complex network theory has driven research innovation and practical applications in agricultural supply chain management, such as emergency supply chain management based on

complex networks, optimization of supply chain networks using complex networks, and studies on supply chain relationships based on complex networks.

Trade supply chain

Globalization has changed the structure of the modern world, and affected to change national economic, political and spiritual development strategies, and made nations interdependent in these days(Rode & de Viteri, 2018). Due to the deepening globalization today, businesses in countries barely rely on domestic. The practitioners of supply chain management inevitably think and run businesses globally (Mentzer et al., 2001), and supply chain has always been an important part of global trade and globalization and made the world interdependent (Angeleanu et al., 2016).

Trading supply chain is a view represented in this research, and it combines trade with supply chain. Trade is more like an activity that participants exchange with each other in the moves of buying and selling, which activity also is contained in supply chain. Supply chain visually shows a relationship in a system of organization, people, activity, information, and resources. The movement normally contains transforming natural resources, raw materials, and components into finished products delivered to customers (Kozlenkova et al., 2015). Trade supply chain can be viewed as a comparatively fixed movement in trading between exporter and importer. The old traditional trade between countries based on simply goods exchanging, over time, the business integrated sections such as specifical logistics business for international trade, regulation for anti-exchange-dumping and food safety, monetary settlement, etc. When the participants between buyers and sellers are from two or more countries, the activity that one nation makes goods and sells into another nation called international trade (Baldwin, 2012). Therefore, areas of trade and supply chain overlap with each other, and specially the issue across international business is different with domestic business, which has to consider non-trade factors such as services provided by national customs. The differences between traditional supply chain and international supply chain are followed by modes of transportation, countries and regions, time zones, natural environments, social and economic circumstances, legal systems, cultures, customs and conventions, languages, management styles, technologies, and equipment (Pham et al., 2020). Flexibility and uncertainty have widely been considered by scholars. Risks run

through the whole supply chain especially in international trade. In trading supply chain, the risks divided into the areas that covered by supply chain and policy, the amount of modes of transportation, the speed of transportation, popularization of technical infrastructure and other random factors (Prater et al., 2001). Trade supply chain represents a processing that aims to deliver product to the buyers with specific terms which regulars the necessary conditions(Juma et al., 2019). By reviewing literatures, traceability occupied mostly in traditional research of supply chain and food safety. In six T's model, traceability, transparency, time, testability, training, and trust are important attribute in evaluating food safety. In addition, tactics and target also relate to the attribute in behavioral issues, chain structure issues, public and private standards(Machado Nardi et al., 2020). Internationalization has always been impeded by transaction costs which are relevant to international supply chain management and separate the chain into more parts. Balance between transaction costs and production costs plays an important role in strategic decisions (Berghuis & den Butter, 2017). Trade costs are widely considered as a significant determinant in regional and global value chains (Manfred, 2018). By viewing strategic management and analyzing offshoring and outsourcing in global value chains, internationalization theory has proved that only supply chain with efficient configurations survives in the increasing international business competition (Casson, 2018).

International commercial contract takes an important role in international trading, and it unifies and harmonizes global business (Acharya, 2020). Incoterms is a consensus term of trade in the world, which is owned by International Chamber of Commerce (ICC). The rule has been extensively used in filling a purchase order, packaging, and labelling a shipment for freight transport, or preparing a certificate of origin at a port internationally and domestically. Nowadays, the term has been amended to "Incoterms 2020" which has been developed by ICC in 2019. The past rules published in 1953, 1967, 1976, 1980, 2000, 2010. Incoterms 2020 currently covers four modes of transport which are waterway, air freight, railway, and vehicle. The modes for transportation are defined into Ex Works (EXW), Free Carrier (FCA), Carriage Paid to (CPT), Carriage and Insurance Paid to (CIP), Delivered at Place (DAP), Delivered at Place unloaded (DPU), and Delivered Duty Paid (DDP). In addition, when the transport is running through waterway which includes sea way and inland waterway, the

agreement could be involved by Free Alongside Ship (FAS), Free on Board (FOB), Cost and Freight (CFR), and Cost, Insurance and Freight (CIF). The details of Incoterms 2020 followed by Figure 9:

	Freight Collect Terms						Freight Prepaid Terms				
Groups	Any Mode or Modes of Transport		Sea and Inland Waterway Transport				Any Mode or Modes of Transport				
Incoterm®	EXW	FCA	FAS	FOB	CFR	CIF	CPT	CIP	DAP	DPU	DDP
	Ex Works (Place)	Free Carrier (Place)	Free Alongside Ship (Port)	Free On Board (Port)	Cost and Freight (Port)	Cost Insurance & Freight (Port)	Carriage Paid To (Place)	Carriage & Insurance Paid to (Place)	Delivered at Place (Place)	Delivered at Place Unloaded (Place)	Delivered Duty Paid (Place)
Transfer of Risk	At Buyer's Disposal	On Buyer's Transport	Alongside Ship	On Board Vessel	On Board Vessel	On Board Vessel	At Carrier	At Carrier	At Named Place	At Named Place Unloaded	At Named Place
Obligations & Charges:											
Export Packaging	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Loading Charges	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Delivery to Port/Place	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Export Duty, Taxes & Customs Clearance	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Origin Terminal Charges	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Loading on Carriage	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Carriage Charges	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Insurance	Negotiable	Negotiable	Negotiable	Negotiable	Negotiable	*Seller	Negotiable	**Seller	Negotiable	Negotiable	Negotiable
Destination Terminal Charges	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller
Delivery to Destination	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller
Unloading at Destination	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Buyer
Import Duty, Taxes & Customs Clearance	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller

Figure 9 Incoterm 2020

Source: ICC, 2019

EXW: *"the seller delivers when it places the goods at the disposal of the buyer at the seller's premises or at another named place (i.e., works, factory, warehouse, etc.). The seller does not need to load the goods on any collecting vehicle, nor does it need to clear the goods for export, where such clearance is applicable."*

FCA: *"the seller delivers the goods to the carrier or another person nominated by the buyer at the seller's premises or another named place. The parties are well advised to specify as clearly as possible the point within the named place of delivery, as the risk passes to the buyer at that point."*

CPT: *"the seller delivers the goods to the carrier or another person nominated by the seller at an agreed place (if any such place is agreed between parties) and that the seller must contract for and pay the costs of carriage necessary to bring the goods*

to the named place of destination."

CIP: *"the seller delivers the goods to the carrier or another person nominated by the seller at an agreed place (if any such place is agreed between parties) and that the seller must contract for and pay the costs of carriage necessary to bring the goods to the named place of destination. The seller also contracts for insurance cover against the buyer's risk of loss of or damage to the goods during the carriage. The buyer should note that under CIP the seller is required to obtain insurance only on minimum cover. Should the buyer wish to have more insurance protection, it will need either to agree as much expressly with the seller or to make its own extra insurance arrangements."*

DAP: *"the seller delivers when the goods are placed at the disposal of the buyer on the arriving means of transport ready for unloading at the named place of destination. The seller bears all risks involved in bringing the goods to the named place."*

DPU: *"the seller delivers when the goods, once unloaded from the arriving means of transport, are placed at the disposal of the buyer at a named place of destination. The seller bears all risks involved in bringing the goods to and unloading them at the named place of destination."*

DDP: *"that the seller delivers the goods when the goods are placed at the disposal of the buyer, cleared for import on the arriving means of transport ready for unloading at the named place of destination. The seller bears all the costs and risks involved in bringing the goods to the place of destination and has an obligation to clear the goods not only for export but also for import, to pay any duty for both export and import and to carry out all customs formalities."*

FOB: *"the seller delivers the goods on board the vessel nominated by the buyer at the named port of shipment or procures the goods already so delivered. The risk of loss of or damage to the goods passes when the goods are on board the vessel, and the buyer bears all costs from that moment onwards."*

CFR: "*the seller delivers the goods on board the vessel or procures the goods already so delivered. The risk of loss of or damage to the goods passes when the goods are on board the vessel. the seller must contract for and pay the costs and freight necessary to bring the goods to the named port of destination."*

CIF: *"the seller delivers the goods on board the vessel or procures the goods already so delivered. The risk of loss of or damage to the goods passes when the goods are on board the vessel. The seller must contract for and pay the costs and freight necessary to bring the goods to the named port of destination. The seller also contracts for insurance cover against the buyer's risk of loss of or damage to the goods during the carriage. The buyer should note that under CIF the seller is required to obtain insurance only on minimum cover. Should the buyer wish to have more insurance protection, it will need either to agree as much expressly with the seller or to make its own extra insurance arrangements."*

Incoterms, as an influential term around the world, clearly define the commitments between sellers and buyers. Incoterms offered a standard rule for merchants on trading, and the choice of the mode impacts on cost, risks, liabilities and formalities which directly change the profits in business (Malfliet, 2011). Policy makers should pay more attention on incoterms clauses to monitor, evaluate and benchmark the transportation and logistics performance (Stojanović & Ivetić, 2020).

In conclusion, reviewing the latest details of Incoterm contributes this research to analysis the risks, costs, responsibilities, and the like of each section in the chain. Incoterm, as a widely used agreement for international trade in the world, acts an important role for guiding trade communities in partition of cost, risks, liabilities, and formalities. This research is mainly related by cost in the chain, so the knowledge and application of Incoterm 2020 should be mentioned. In addition, the author needs to use Incoterms to determine the duty paid value.

In conclusion, trade supply chain can be generalized a phenomenon of international trade process in this research. The parties in the chain included by trade community, customs broker, customs agency, freight forwarder, port operator, and ship agent. The trade process itself can be viewed as a production process. The supply side starts from exporter and the demand side ends with importer. Generally, an important factor what supply chain management research for is coordination, and without this factor the chain very likely appears asymmetric information which causes bullwhip effect as a result of inaccurate prediction (Buchmeister et al., 2012). Since there are few review articles on trade supply chains, in order to systematically understand the content of trade supply chains, this research aims to create and compete the view of trade supply

chain in the case of international trade between Thailand and China based on bibliometrics with Cite Space.

Agricultural product trade supply chain

Agricultural product trade supply chain specifically refers to consider bilateral or multilateral trade in agricultural product, describe the relationship of the trade to be identical supply chain, and try to manage the process for optimization, especially through collaboration.

Blockchain as a high technological solution has been argued the application in academia and the practice. Its technique of traceability implicates a better quality, safety and sustainability of agricultural supply chain in international trade (Kamble et al., 2020).

With the development of technology and the education of consumers in food safety, some scholars started researching traceability, safety and sustainability issues in agricultural supply chain (Kittipanya-Ngam & Tan, 2020).

1. Research on Agricultural sustainability

The escalating concerns surrounding climate change and the depletion of natural resources have led to a greater recognition among individuals of the need to minimize their environmental impact. This increased awareness can be attributed to various factors, including heightened media coverage of environmental issues, influential figures advocating for change, and the adoption of sustainable practices by businesses and governments. Agricultural sustainability, an integral aspect of overall sustainability, plays a crucial role in addressing existential challenges like food scarcity, environmental degradation, and economic instability. Food challenges exhibit regional and country-specific variations, with underdeveloped regions such as Africa grappling with issues like low crop yields, climate change effects, and food insecurity. Conversely, Asia faces its own set of challenges, including unmet demand, undernourishment, and unsustainable agricultural practices (Grote et al., 2021). Following the COVID-19 outbreak, food concerns have gained significant attention, prompting scholars to focus on studying food safety through the lenses of food stability, availability, access, and utilization (Adhikari et al., 2021; Devereux et al., 2020; Laborde et al., 2020; Niles et al., 2020). Moreover, environmental issues have troubled

human for years. The scale and complexity of environmental issues have increased, driven by factors such as population growth (Khan et al., 2021), urbanization (Yang et al., 2020), and economic development (Khan et al., 2019). Nowadays, environmental issues such as climate change (O'Neill et al., 2020), biodiversity loss (Tickner et al., 2020), and pollution are major global challenges that require urgent action. Furthermore, economic factors are vital in ensuring the sustainability of agriculture as it is impacted not only by natural conditions but also by market forces. A study reveals how economic factors, including food demand, input costs, and government policies, can affect the profitability in the short term and the long-term sustainability of farming practices (Kremen et al., 2012). Therefore, it is essential to consider economic factors when developing strategies to promote agricultural sustainability.

Agriculture is one of the world's largest economic sectors, and sustainable agricultural development plays an important role in today's global economic and environmental agenda (Lang, 2013). Sustainable agricultural development needs to cover the entire agricultural supply chain (ASC), including production, processing, storage, transport, trade, and consumers, to ensure minimal environmental, social, and economic impacts.

Firstly, the sustainability of agricultural trade supply chains relies on the sustainability of agricultural production. This involves ensuring the protection of soil and water resources, adopting responsible practices for the use of fertilizers and pesticides, and enhancing agricultural production methods (Horrigan et al., 2002). To enhance the resilience of agricultural systems, Jung et al. (2021) implemented cutting-edge technologies such as remote sensing and artificial intelligence (AI). Additionally, I integrated the power of big data into predictive and normative management tools. The application of WebGIS framework also helped for the smart farms (Delgado et al., 2019). Although nanotechnology has be-come one of the technologies that have changed traditional agriculture, such as nano additives, nano fertilizers, nano pesticides, nano growth promoters, etc. but toxicity and safety problems still exist in the application of nanotechnology (Ashraf et al., 2021).

Secondly, the sustainability of processing and storage of agricultural products is related to the maintenance of quality and freshness of agricultural products, as well as energy consumption and environmental pollution. Applying renewable energy such

as solar energy, into the cooling and drying processes of agriculture products plays an important role in sustainable farm produce (Lamidi et al., 2019).

Thirdly, the transportation and logistics of agricultural products involve transportation, packaging, storage and distribution, and its sustainability is related to the quality and food safety of agricultural products, as well as environmental and social benefits. Gerassimidou et al. (2021) proposed a sustainable decision matrix to support the use of bio-based plastic food packaging as an alternative to petrochemical based plastics, as its side effects on production, consumption and management systems have not been explored. Meanwhile, Fuel cost optimization is the core issue of agriculture logistics since fuel consumption is most directly linked to transportation, loading and storage infra-structure. The fragmentation of transport and storage infra-structure should be addressed through a combination of farm-operated trucks and transport outsourcing (Gao et al., 2019).

Fourthly, the sustainability of agricultural trade includes different levels of trade patterns, such as international trade, regional trade, and local trade. In international trade, the import and export of agricultural products involves policies, regulations and standards of different countries and regions, and their sustainability is related to economic, environmental, and social impacts. International trade positively affects global progress to-wards nine environment-related SDG targets but reduces the SDG target scores of over 60% of evaluated developing countries in research about impacts of international trade on global sustainable development, which conclude that distant trade contributes more to achieving global SDG targets than adjacent trade, and enhancing accounting for virtual resources in trade is essential for achieving sustainable development for all (Xu et al., 2020). Renewable energy is a facet of agricultural energy and has demonstrated a positive relationship with international trade. Furthermore, renewable energy has been found to have a beneficial impact on environmental quality and plays a constructive role in supporting ecological sustainability. These findings suggest that policies promoting the use of renewable energy sources can contribute to enhancing economic growth while fostering sustainable development aligned with environmental goals. Incorporating eco-friendly measures into policies and practices will aid in comprehending the role of renewable energy in supporting eco-environmental sustainability and encouraging international trade (Khan et al., 2020).

Fifthly, consumer and market sustainability include aspects such as consumer habits and needs, marketing strategies and sales channels. Consumer awareness and demand for sustainability is an important factor in the sustainability of agricultural trade supply chains. Consumers associate sustainable products with being environmentally friendly, healthier, using fewer chemicals and having better quality. However, consumers are not fully aware of the importance of sustainability, tending to associate it with just organic farming and higher quality (Sánchez-Bravo et al., 2021). To ensure food security, a holistic approach to managing the agricultural value chain is required, encompassing all pre-harvest and post-harvest activities. This necessitates the development of a new food marketing management system that entails a thorough evaluation of all components in-volved in the process (GÖKKÜR & SINAV, 2020).

2. Research on Thai agricultural supply chain

For examining role of farmer organization and networks in rice supply chain, due to the cooperative network, the key production and marketing problems such as increased transaction costs and market uncertainties reduced. There are two relationships of rice supply chain in the case above, which are two-stage network and three-stage network. The first one is divided by agricultural cooperative, rice producer, and another agricultural cooperative, rice buyer; The second one covers an interlinkage among upstream cooperative (producer), intermediary cooperative and downstream cooperative (buyer) (Sathapatyanon et al., 2018).

Cooperative networks in fruit supply chain also benefit the cooperatives and its member farmers in raising bargaining power, enhancing fruit quality, reducing harvest costs, decreasing financial cost and easily obtaining information in the market with three systems which are linkage to supermarket, business with traders, and bi-cooperative or multi-cooperative network (Kuwornu, 2019).

Thai parboiled rice can generate higher profits and increase competitiveness in export market by improving Values Stream Mapping. With the production of parboiled rice, the process starts with paddy selection, pre-cleaner, pre-steaming vessels, soaking vessels, steaming vessels, pre-dryers, column dryers, storage silos, pre-cleaner, milling, whitening, and grading. Every step of parboiled rice supply chain in the map belongs to three type of activities which are value added (VA), non-value added (NVA), and necessary-non-value added (NNVA) (Wattanutchariya et al.,

2016).

Digitalization has been widely discussed in academia. With cases study of food supply chain in Thailand, digitalization partly helps participants to deal with the key problems in traceability, safety, and sustainability which are gradually required by customers. The existing applications in food supply chain digitalization involved artificial intelligence (AI), Internet of things (IoT), robots, virtual reality (VR) & augmented reality (AR), block chains, 3D printing, and drones, which make widely and the value proposition better in efficiency, transparency & traceability, environmental & social impacts, legal culpability, and E-market/supply accessibility (Kittipanya-Ngam, & Tan, 2020).

Thailand was a main seafood exporting country in ASEAN which occupies 12% share of seafood supplying market in the world. With reviewing data and reports collected by government and interviewing senior practitioners, the factors like laws and regulations and depletion of natural resources reduce the competitiveness of Thai seafood export. Paying more attention on media, news, regulation, and local communities and sustainability could be the important points to deal with global seafood market (Prompatanapak, & Lopetcharat, 2020).

Cassava chip, as one of Thai most important agricultural product, is highly valued by the government in support of agricultural economic. To improving the performance of supply chain, collaborative supply chain provides six important collaborative success factors, which are Business Management, Information Technology, Value Added Process, Supply Chain Relationship, Top Management Commitment, Partnership, Service Quality, Process, Resource Capability, Environment Uncertainties, Customer Satisfaction (Chintanapunt, & Pichyangkura, 2020).

Through analyzing a case of medium rice company, supply chain integration has been identified that vertical development contributes increasing quality and quantity of organic rice, and the research also shows a map of organic rice supply chain in Thai medium company (Prasertwattanakul, & Ongkunaruk, 2018).

In conclusion, Thai agricultural supply chain emphasizes cooperation, networking, and integration. As most of the articles show that Thai agricultural supply chain is keen to discuss optimization based on traditional supply chains. Most researchers hope that participants in the supply chain can have a rational long-term

perspective. As a large trading country of traditional agricultural products, Thailand has an excellent foundation in the international marketing of agricultural products. The author hopes to find more ways to explain the current situation of the APTSC between Thailand and China from the study of cost and time.

3. Research on Chinese agricultural supply chain

China has taken an important part in applications of Internet technology in the world. China's e-commerce market came from 2005, and has been built up in the end of 2011 (Ye et al., 2020). According to the report of China Consumer Association, Chinese the combine business mode of e-commerce and live-stream sales has taken 433.8-billion-yuan market size in 2019, and expected growth would keep going up in 2020. And the report also presents the survey data of reasons of watching and procurement in live-stream, which shows the main reasons willing to watch live-stream are that collecting information of the products and having promotion from factories, and the main reasons that procurement in live-stream are involved believing the prices are reasonable and being attracted by the showing products on the screen.

With the improvement of quality of life, food safety has attracted more and more attention from Chinese consumers. The researchers used radio frequency identification technology and blockchain technology to establish the traceability system of agricultural supply chain. Among them, the process of agricultural supply chain is divided into production, processing, warehousing, distribution and sales, transmission, and data sharing. Food safety can be effectively ensured through data collection and analysis of these processes (Tian, 2016).

For Chinese agricultural companies, agricultural supply chain can be constructed with a Technology-Organization-Environment (TOE) framework. After analyzing by using Structural Equation Modelling, the factors about resistance from employees and uncertainties are not significant, but the technical factors such as complexity, compatibility, perceived benefit, and cost effect complicatedly on the technology adoption of IoT in agriculture. Besides, organizational factors and environmental factors, such as scale of enterprise, executive support, trust among the businesses in the supply chain, technical knowledge, external pressure, and government support have positive relationships with IoT adoption (Lin et al., 2016).

Trust is sensitive to organizational factors, which is also the basis for cooperation. In agricultural supply chain, the specific performance is whether farmers can share information with enterprises is crucial. A survey of 462 farmers in China and the testing of conceptual models and related assumptions showed that dependencies had a significant positive impact on trust and commitment but had no direct impact on information sharing. Still, the researchers found that trust and commitment had a positive impact on information sharing. In other words, by increasing farmers dependence on companies, farmers trust and commitment can be fostered, thus encouraging them to share information with businesses (Fu et al., 2017).

China, as one of the largest importers of agricultural products on the world, has never lacked competition. Competition, while helping the industry to develop, can also lead to a reduction in profits. Today, more and more companies are proposing the concept of cooperative competition in order to seek strategic cooperation with suppliers. And how to cooperate is the key. Scholars have concluded that product competitiveness, communication skills, operational skills, and information sharing skills are key factors affecting cooperative performance. Then, scholars draw the importance of cooperation with suppliers through fuzzy hierarchical analysis (Zhu et al., 2016).

Improving the quality of agricultural products is essential to promoting agricultural development. In the current research of agricultural supply chain, contract agriculture is generally recognized by the public. After collecting data on 78 Chinese agricultural enterprises and 321 farmers, scholars learned that different types of power have different effects on contract agriculture. Non-economic power positively affects supply chain integration, and even its impact on process coordination is greater than the impact of information sharing. The economic impact on supply chain integration is different (Fu et al., 2020).

The financial problems of Chinese agricultural supply chain have also attracted much attention in academia. Scholars try to achieve both channel coordination and information sharing in supply chains where demand is uncertain. Based on the option contract model of the supply chain of fresh produce, this paper compares the production, profit, risk, and information sharing status under different circumstances. The study found that optimized option contracts can help the supply chain achieve

channel coordination and Pareto improvement. In this way, options contracts can help maintain cooperation by encouraging retailers to share market demand information with producers (Liñán et al., 2019).

Cost benefits, financial performance, and relationships with key actors are key to influence supply chain performance. Analyzing the costs, benefits, operations, and financial performance of participants in the chain by extracting data from the grape supply chain collected in five regions of China. The results show that farmers account for the highest proportion of total net profit and create the highest value. Nevertheless, due to production and market risks, fluctuations in the prices offered by farmers, and the dominant relationship between buyers and wholesalers, farmers have to face uncertain returns. In addition, while all participants in the grape supply chain are profitable, they still face many challenges, such as the disarray and fragmentation of production systems, asymmetries in power, and inadequate information sharing (Lei et al., 2016).

In conclusion, the research of Chinese agricultural product supply chain depends on Chinese relatively developed Internet high-tech applications and relatively rich infrastructure construction. But it is worth mentioning that Chinese leading consumption market and actively cooperating aspiration in Asia have been paid attention to by many scholars and enterprises. At present, China and Thailand signed many cooperation agreements, which involve the areas about currency, electronic science and technology cooperation, provide unlimited possibilities to the future of agricultural trade between the two countries. This study will also continue to focus on the impact of these collaborations on supply chain optimization using financial products and services as tools.

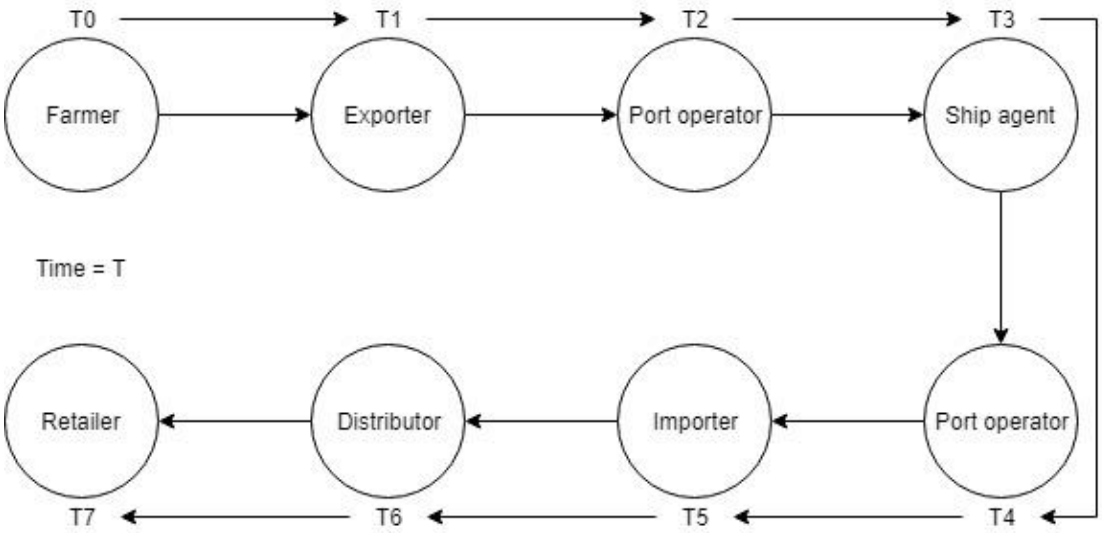
In summary, a review of the agricultural supply chain studies in China and Thailand allows for a clearer definition of the APTSC between China and Thailand. Thus, the APTSC proposed in this study is more convincing. In addition, these studies can provide theoretical reference for future researchers trying to learn APTSC. It is worth mentioning that although many researchers in many studies mention the benefits of advanced technology, but from the point of view of technological innovation to promote product supply chain upgrading, these researchers do not give very specific application details, but only after the list of technical terms may be involved.

4. Relationships among the APTSC between Thailand and China

The APTSC is constituted by Thai agricultural product supply chain and Chinese agricultural product supply chain (APSC) and trade supply chain. In the other word, Thai APSC, Chinese APSC, and the trade supply chain have been considered by a whole supply chain which named APTSC. Besides, time is a significant factor to efficiency of the chain. The less time that product stays in the chain, the more efficient the chain is. Especially, agricultural product usually is easy to be rotten with the time is ticking. Nowadays, people use techniques to make sure the product fresh, such as container with frozen system, chemistry in the product, etc. However, the author decides to examine the timing to observe the chain for the optimization research. The research aims to deal with agricultural product whose quality depraves with the timing gone, which means the chain needs to deliver the product to consumers before its value becomes rotten.

The total cost of this APTSC equals to the cost of Thai and Chinese agricultural product supply chain and trade supply chain. The total time counts from the product when is harvested to the final product consumers accept. The variable Time equals to the day when agricultural product has been harvested.

Overall, the APTSC has showed basic relationship of each section, and made clear that once the product goes through a section, the cost unavoidably increases without supply chain optimization. The research pays attention to examine what can supply chain management do with this process? If each section provides the fixed price, the profit in the chain very likely increases with the decreasing cost. And when the optimization about the chain achieves the total cost of the chain declined, the total profit theoretically enhances with the comparative fixed price. Likewise, timing in the chain is important because of the factors like perishability. The total time of the product delivered should not be over than the perishable time of the product. Therefore, this research provides the relationships followed by Figure 9 and Figure 10:



The APTSC Time:

Figure 10 Relationship among the APTSC in time

$$Total\ Time \geq \mathrm{T0} + \mathrm{T1} + \mathrm{T2} + \mathrm{T3} + \mathrm{T4} + \mathrm{T5} + \mathrm{T6} + \mathrm{T7} = \sum_{k=1}^{T_7} T_k$$

The APTSC cost:

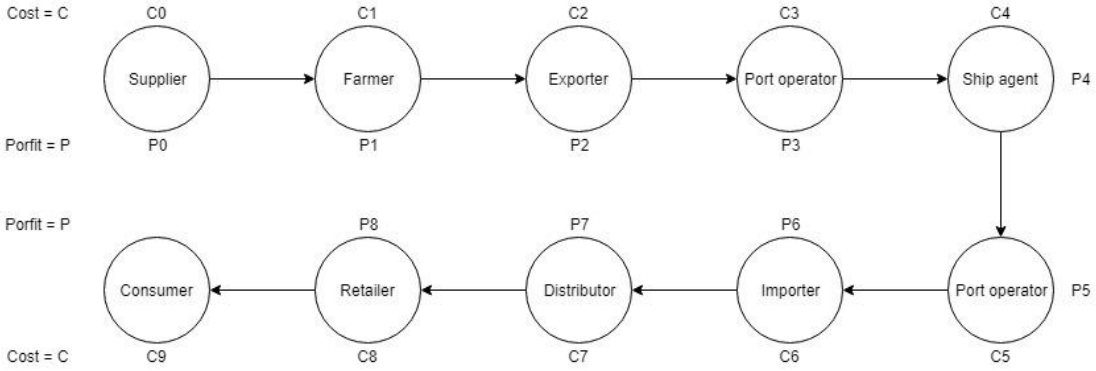


Figure 11 Relationship among the APTSC in cost

$$\text{C9 (The price that consumers buy the product)} \geq \text{C8} + \text{P8} = \text{C7} + \text{P7} + \text{P8}$$
$$= \text{C6} + \text{P6} + \text{P7} + \text{P8}$$
$$= \text{C5} + \text{P5} + \text{P6} + \text{P7} + \text{P8} + \text{C4} + \text{P4} + \text{P5} + \text{P6} + \text{P7}$$
$$+ \text{P8} = \text{C3} + \text{P3} + \text{P4} + \text{P5} + \text{P6} + \text{P7} + \text{P8}$$
$$= \text{C2} + \text{P2} + \text{P3} + \text{P4} + \text{P5} + \text{P6} + \text{P7} + \text{P8}$$
$$= \text{C1} + \text{P1} + \text{P2} + \text{P3} + \text{P4} + \text{P5} + \text{P6} + \text{P7} + \text{P8}$$
$$= C1 + \sum_{k=1}^{P_9 - 1} P_k$$

Financial supply chain

Financial supply chain (FSC) is an emerging concept that has garnered increasing attention in recent years. It focuses on the management and optimization of financial flows within a supply chain network, aiming to reduce cost, enhance efficiency, and achieve stable and competitive supply chain operations. This literature review will investigate the concept of FSC and FSC management through reviewing relevant literature, discussing their importance for supply chain management, and identifying the key factors and challenges involved. Financial supply chain refers to the flow of financial transactions and information between different entities in a supply chain network, including suppliers, buyers, banks, and other financial intermediaries (Li et al., 2016). These transactions may include payment, financing, factoring, insurance, and other financial services. FSC is closely related to physical supply chain management as it enables the smooth and efficient movement of goods and materials throughout the supply chain by facilitating timely and secure payment and settlement. FSC management involves the coordination and optimization of financial flows within the supply chain network to reduce risk, cost, and uncertainty, while enhancing efficiency, transparency, and competitiveness. According to Li et al. (2016), FSC management can be divided into two categories: upstream and downstream management. Upstream management focuses on optimizing the financial relationship between suppliers and buyers, such as payment terms, pricing, and credit risk assessment. Downstream management, on the other hand, deals with the financing and cash management of the entire supply chain network, including inventory financing,

accounts receivable factoring, and supply chain finance. FSC and FSC management have become increasingly important due to several reasons. Firstly, the globalization of supply chains has led to longer and more complex supply chains, which make it difficult to manage financial flows efficiently and effectively (Pan et al., 2020). Secondly, the traditional financing methods, such as bank loans and factoring, are becoming less accessible and costly for small and medium-sized enterprises (SMEs) due to tightened credit policies and increased competition (Li et al., 2016). Thirdly, the advancement of financial technologies, such as blockchain and mobile payments, has provided new opportunities for FSC optimization and innovation (Wu et al., 2020). Several factors and challenges need to be considered when managing FSC. Firstly, the information and communication technology infrastructure should be robust and secure to ensure timely and accurate data exchange and processing (Pan et al., 2020). Secondly, the legal and regulatory framework should be clear and consistent to reduce uncertainty and risk for all parties involved (Wu et al., 2020). Thirdly, the credit risk assessment and management should be sound and reliable to minimize default and non-payment risks (Li et al., 2016). Fourthly, collaboration and trust among the supply chain partners are critical to ensure mutual benefits and long-term relationships (Tan et al., 2018). Finally, the cultural and institutional differences across different countries and regions should be taken into account to avoid misinterpretation and conflicts (Pan et al., 2020). Overall, FSC and FSC management are essential concepts for modern supply chain management, as they allow for the optimization and coordination of financial flows within a complex and globalized supply chain network. FSC management can enhance efficiency, transparency, and competitiveness by reducing cost, risk, and uncertainty. However, several challenges and factors need to be addressed, such as information security, credit risk, legal and regulatory framework, collaboration and trust, and cultural and institutional differences. Future research in this area should focus on developing new FSC models, technologies, and policies that can better support the needs of SMEs and promote sustainable and inclusive supply chain development.

In current research, scholars of FSC and FSCM involve many areas as research objectives.

Financial supply chain management points on managing financial flow in supply chain. Normally, participants in the chain all are willing to secure short or medium term funding which is significant topic in these days with globalization (Sugirin, 2009). Every partner in the chain mostly does business with upstream supplier and downstream buyer, when the payment flow is shown in the whole chain, people call it as financial flow in supply chain. Prospectively, if the payment is not paid as contract required, breaker must suffer penalty. Moreover, due to any unused cash could earn benefit from interest, the penalty offered the contract should be very clearly in setting for reparation (Gupta & Dutta, 2011). Financial supply chain management in the APTSC is one of the core objectives in this research, and only financial supply chain management knowledge relevant with agricultural product, international trade, and business above mentioned between Thailand and China should be mentioned in this part. Also, recently, a new word about electronic currency, which based on blockchain. And blockchain has been widely considered by supply chain finance.

Supply chain finance (SCF) is a financing model for banks to link core enterprises with upstream and downstream enterprises to provide flexible use of financial products and services, which means taking capital as a solvent in the supply chain to increase its liquidity. SCF aims to optimize financial flow of funds and implement solutions at an inter-organizational level through financial institutions or technology providers, with the ultimate goal of improving cash flow management from the supply chain perspective by keeping the flow of funds consistent with the product and information flow (Gelsomino et al., 2016). After the financial crisis in 2008, traditional small-medium enterprises (SMEs) lack of access to credit because banks continued to use the outdated credit model and asset regulation (Lekkakos & Serrano, 2016). SCF gives financial, technological, and managemental tools for optimization of asset management and provides more possibility of the portfolios in supply chain processes and delivery (Caniato et al., 2016).

An article systematically reviews literatures and introduces a concept of business ecosystem in domain of SCF. The researcher proposed the framework and future interest of the SCF ecosystem research. However, due to the research still be nascent, scholars need to discuss it until the standards has been strengthened (Bals, 2019).

Real options, as a hot topic in western financial research, has been contributed by providing a theoretical debate in SCF literature on effectiveness of supply chain risk management strategies in mitigating commodity price volatility. The paper designs a tool to evaluate the effectiveness of adopting the two sourcing strategies for mitigating commodity price volatility under different conditions. Managers are allowed to choose the most appropriate mitigation strategy depending on the context (Pellegrino et al., 2019).

Research combines network theory and resource dependency theory and provides a non-traditional perspective that network structure does not only effect resource access, but also financial performance of the company. In other words, when decision maker considers procurement, the relationship between network structure in supply chain and financial performance of the company should be noticed. And manager should concern first-degree base connections and extended network of the company if they effect the financial performance (Carnovale et al., 2019).

A scholar observes the case studies of buyer-supplier-financial service providers and put a contribution that combines the contingency approach with social exchange theory, transaction cost economics, and principal agent theory for inter-organizational financing. Besides, the finding also explains the reasons that suppliers promise to SCF, which are financial, cash flow-related, and relational (Martin & Hofmann, 2019).

Game theory develops SCF by Stackelberg bilevel optimization model (nonlinear programming). In a manufacturing case, scholar provides a model for interaction between supplier and buyer. The model prescribes an emulated dynamic credit term over multiple time periods, which helps decision maker to plan and evaluate both the in-bound and out-bound cash flows as a result of the credit term, production, ordering, and inventory (Li et al., 2019).

With conjunction between SCF and stakeholder theory, limitation of traditional finance for SMEs can be possibly released. The study concerns four kinds of stakeholders which are buyer, supplier, financial institute, and technology provider. As a result, the paper presents that buyer is able to support strategic supplier for handling supplier risk assessment. Supplier can endorse credit for buyer by reaching an agreement with the purchaser. What the most important thing that financial institute

should do is improving the accuracy of ratings, especially for SMEs. Finally, technology provider can develop service for providing innovative and improved solution (Moretto et al., 2019).

Through researching a famous three stage agri-food supply chain company, a scholar compared hard tolling and contract farming schemes, and puts soft tolling forward, which ensures a possibility that a win-win situation for every participant in the chain, and giving a division of benefit by agreement or contract. The research points the decision in choosing those three contracts has been affected by production time as a result of capital stress (Van Bergen et al., 2019).

In summary, SCF has undergone significant development over the years, stemming from concerns surrounding funding for logistics companies. Initially, SCF lacked specificity and differed little from traditional credit, although bankers benefitted from its expansion. However, recent research has focused on deepening combined supply chain management and presenting methods for managing financial flows within the chain using advanced technology such as blockchain or other financial technologies. Remarkably, exchange rate risks have received little attention in SCF studies. Currently, the governments of Thailand and China are engaged in wide-ranging cooperation, with potential implications for the performance of the Asia-Pacific Trade Agreement (APTA), particularly in bolstering agricultural companies' benefits in both countries. Ultimately, the resolution to these research issues will likely require the application of financial knowledge.

1. Financial agricultural supply chain

The agricultural supply chain is a complex, dynamic system impacted by numerous factors ranging from environmental constraints and Government policies to technological advancements, which may modify or amplify the nature of each of these stages. The agricultural supply chain in a broader sense involves production (Fuglie et al., 2012), processing (Zilberman et al., 1991), distribution (Reardon et al., 2012), and consumption (Gómez et al., 2011). Furthermore, it involves a variety of intermediate operations such as post-harvest handling, storage, processing, and transportation. Managing efficient and effective flows of agricultural goods through the chain is crucial for profitability and sustainability in the long run (Ketchen Jr & Hult, 2007).

Financial management in the agricultural supply chain helps to maintain a balance between growth, profitability, and liquidity. It facilitates risk management against potential disruptions, such as natural calamities or market volatility, and is essential in managing capacity, purchasing, and inventory costs (Geman, 2014). Moreover, understanding the financial flows along the chain can provide insights into the value distribution among participants (Kaplinsky, & Morris, 2000).

Effective financial management plays a crucial role in the agricultural supply chain by ensuring the sustainability and success of all its participants. By incorporating proper financial practices, the supply chain can navigate uncertainties and challenges while maximizing growth, profitability, and liquidity. One of the primary benefits of financial management in the agricultural supply chain is its ability to manage risks associated with potential disruptions. Agriculture is inherently vulnerable to various risks, such as adverse weather conditions, diseases, pests, and fluctuating market conditions. These external factors can significantly impact the supply chain's operations and profitability. Through financial management strategies, stakeholders can implement risk management measures to mitigate the impact of such disruptions. This includes maintaining adequate financial reserves, securing insurance against potential losses, and diversifying their product offerings to reduce dependence on a single market or crop. Furthermore, financial management in the agricultural supply chain is essential for effectively managing capacity, purchasing, and inventory costs. Understanding the financial implications of production capacity enables stakeholders to make informed decisions regarding investment in infrastructure, machinery, and technology. By optimizing the production capacity, participants can achieve economies of scale, reduce costs per unit, and enhance profitability. Similarly, proper financial management assists in the efficient management of purchasing and inventory costs by optimizing procurement processes, negotiating favorable terms with suppliers, and implementing effective inventory management techniques. This ensures that the supply chain operates with minimal working capital tied up in inventory while maintaining adequate stock levels to meet customer demand. In addition to risk management and cost optimization, financial management also provides valuable insights into the distribution of value along the agricultural supply chain. By analyzing the financial flows, stakeholders can identify how value is created and captured at each stage of the chain. This understanding

allows participants to assess the fairness and equity of the value distribution and identify potential areas for improvement. By addressing any imbalances in value distribution, stakeholders can foster stronger collaborations, enhance trust, and create win-win situations for all involved parties. Lastly, financial management is a critical component of the agricultural supply chain, facilitating growth, profitability, and liquidity. It enables stakeholders to navigate risks, optimize costs, and gain insights into value distribution. By incorporating robust financial management practices, participants can foster a sustainable and resilient agricultural supply chain that thrives in the face of unpredictable challenges and changing market dynamics.

Many scholars have also made valuable contributions to research in financial agricultural supply chains. Numerous recent studies and papers have shifted focus towards the financial aspects of the agricultural supply chain, aiming to optimize operations and reduce costs.

A paper provides a comprehensive look at SCF applications and strategies in the agri-food industry, demonstrating how SCF can help agri-food firms address capital constraints and develop competitiveness while also creating economic and social value (Chen et al., 2023). A scholars studied the impact of financial services on agricultural supply chain operations and found that proper financial structuring facilitates smoother logistics, better delivery times, and improved farmer incomes (Li, 2019). In addition, scholars further indicated how innovative fintech solutions could enhance investment in the agricultural sector, making supply chains more robust and efficient (Mutsonziwa, 2021). Moreover, I found that system dynamics is a popular approach for studying financial agricultural supply chains. The use of system dynamics in modelling and understanding the agricultural supply chain has become prominent in the academic world. Characteristics of system dynamics, such as feedback loops and delay recognition, are excellent for simulating financial aspects. Research highlighted the potential of system dynamics to capture non-linear, complex business models, like supply chains (Kunc, 2017). Also, research constructed a system dynamics model for an agricultural supply chain to determine optimal pricing and order quantity decisions. Their study revealed the nonlinear relationships and complexity within the supply chain system (Xu, 2020). By merging systems dynamics and recent research findings, we can fine-tune agricultural financial supply chains even further. For instance, research used

system dynamics to understand the driving factors of agricultural lending and their impact on the overall financial operations of the supply chain (Pant, 2022). The above studies demonstrated how integrating the two paradigms facilitates a better understanding of the financial aspects of agriculture. Further comprehensive research in this combined area stands to revolutionize the agricultural supply chain, providing economic benefits and sustainability.

2. Participants in the APTFSC between Thailand and China

Parties in supply chain are the role in the chain. Every role has its function and closely relates to each other. The research spots the whole chain and observes the cost and timing of them. According to SCOR model, profit of exporter equals to the price minus the cost that involved source cost, making cost, delivering cost, and returning cost. The source cost covers the price from farmer and other material supplier, the making cost contains salary for labors and price from other manufacture, the delivering cost mainly are cost of transportation, and the returning cost is included by all the fee created when the product needs to retreat because of dissatisfaction about the product or service. The total cost of the APTSC is the sum of cost among trading communities, custom broker, customs agency, freight forwarder, port operator, and ship agent. The total time of the APTSC is divided by agricultural production process, trade process, and agricultural mercantile process. Every section in this chain must run with plan, procurement, production, delivering, and returning.

Trading community: Trading community can be considered as exporters and importers in this chain. Both are the most important participants which are the only reason of starting the process. After confirming the willingness of business, exporter and importer should be acknowledged by governors that its product has been authorized for the business. It is worth to mention that food product must pass the test of food safety standard and the relevant inspection. Exporter is the demander of agricultural supply chain in Thailand, and importer is the supplier of marketing supply chain in China. Also, a relationship in the trading supply chain exists from exporter to importer, which makes exporter as supplier to the importer. The chain runs on when the contract between exporter and importer has been affected. The contract will be covered about dealing price, Incoterm (for dividing responsibility and cost), dealing time, etc. Exporter places order and pays to farmer and takes agricultural product for delivering

to next section which is preparing clearance and packing for transferring. When the product arrives into the port, importer would have the product after clearance. Exporter cost equals to the price minus the exporter profit, and the price is that exporter offers to importer. The cost that importer has to pay equals to the price that importer provides to downstream section minus importer profit. Also, importer cost can be viewed as exporter price plus the result of the cost in whole trade process, and it is depending on which method that trade community deals with another.

Customs brokers: Customs broker usually is responsible for the preparation of the shipment declaration information, which will be submitted to the customs agency. Customs broker sometimes could be part of freight forwarder, and it is a necessary section between trading community and customs agency. Customs broker collects necessary documents from trading community and represents it to connect with customs agency. The documents involved a variety of original customs documents, bills, correspondence, etc. Customs broker must be hired by the registered trading community and be authorized by governor. Generally, customs broker is hired by trade community for dealing with customs agency, consequently, its benefit comes as salary from trade community. And the cost of customs broker is mostly clearance works and authentication by government. Customs broker cost equals to the price of custom broker minus customs broker profit.

Customs agency: Customs is an inevitable participant in international trade, which works under the government and services public in the country it belongs to. With the development of economy under the globalization and internationalization, importers and exporters are counting on improving the uniformity, predictability, transparency and efficiency of customs clearance process, but in other side, government requires customs to ensure dangers and risks away from the trading product (Miloshoska et al., 2016). Nowadays, more researchers are discussing the technology assists customs to work for replacement of paper with electronics. E-Customs is not only reducing costs of operation, but also enhancing efficiency in the clearance (Nejad, & Sabzikaran, 2017).

Freight forwarders: Freight forwarder arranges shipments for trading community. After checking the detail of necessary document from trading community (such as commercial invoice, export declaration, bill of lading, etc.), Freight forwarder

collects the product and warehouses in the port. Normally, water transport shipping will be waiting until the cargos fulfill the ship, then the ship departs. Freight forwarder cost equals to the price that it offers to trade community minus the profit of freight forwarder.

Shipping agent: Shipping agent usually deals with the transportation of cargo. This section takes order from freight forwarder and connects with port operator. The cost of shipping agent equals to the price that it offers to freight forwarder (or directly to trade community) minus the profit of shipping agent itself.

Port operators: Port operator manages the port and arrange the cargos. Literatures showed ports are vital components in water transportation, which are the essential connection between water and land. Also, port acts an important role in increasing competition and creating innovation as a connection between logistics and the node in supply chain (Demirbas et al., 2014).

In conclusion, the participants of international trade divided into trading community (importers and exporters), customs agency, shipping agent, port operators, freight forwarders, and customs brokers (Juma et al., 2019). The chain which are given by Figure 12 represents a regular process when an exporter does a business with another importer in different countries. The map clearly shows sections and necessary connections that included by three flows which are material flows, information flows, and financial flows. Generally, each section in the chain ingests other cash flow as selling price, however, some sections in the trade supply chain collect salary by the department which is out of the chain, such as customs agency and port operator. Therefore, those salary that has been identified will not be considered in this research. Before researching the management in this chain, the author is willing to figure out the cost and time separately and totally, then put them into each model for showing the relationship. Then, the author will examine the relationships with performance of the APTSC, and test if supply chain financial products/services work on that.

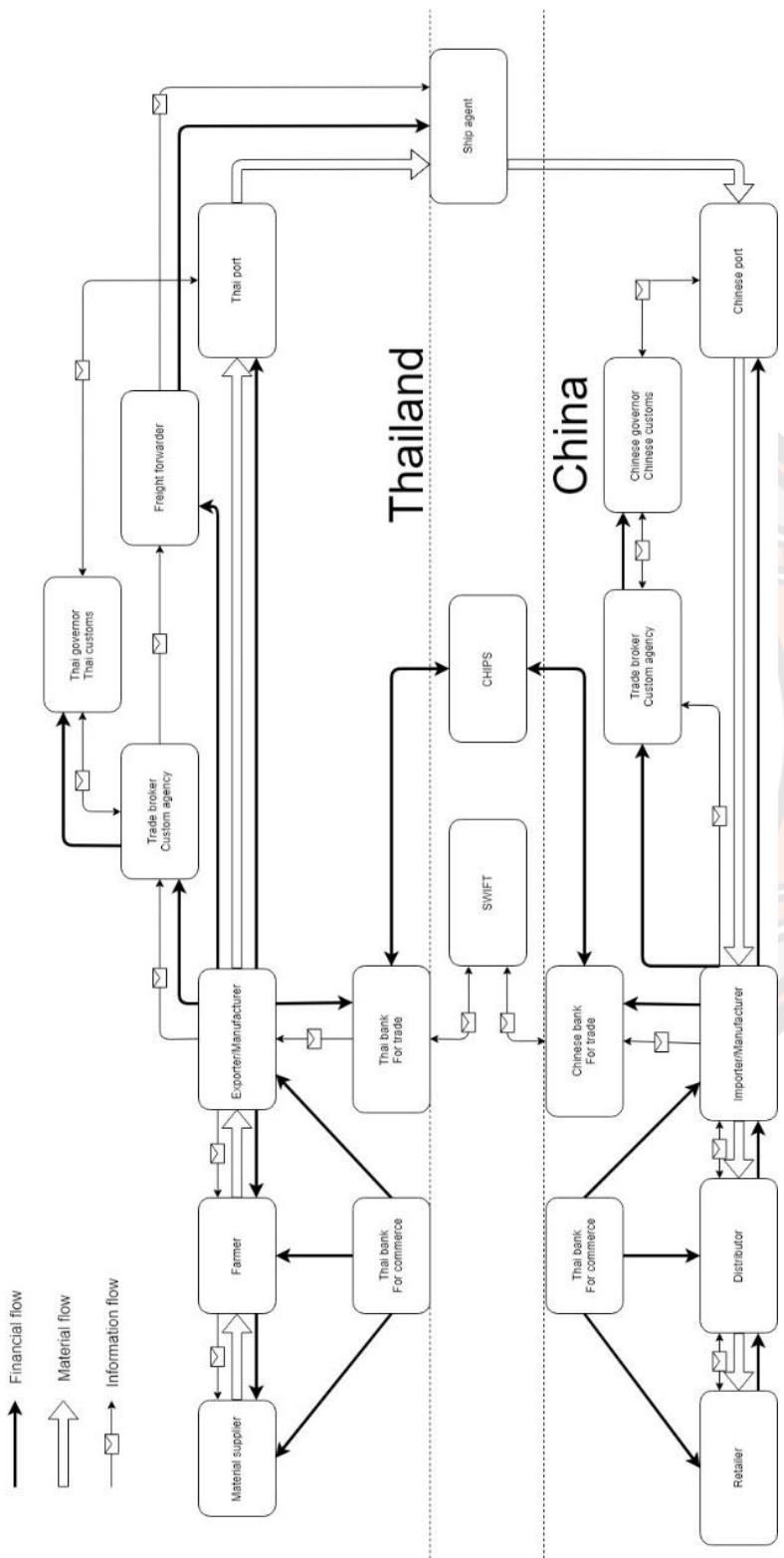


Figure 12 Process of the APTFSC with three flows

Summary

This research highly draws support from supply chain orientation to financial flows in the APTSC between Thailand and China and tries to find out the relationship between SCF products/services and performance of the APTSC. SCF currently works for the funding of SMEs with common sense academically. This research also believes a whole detailed map of the APTSC helps more effective as a result of that researchers, managers of each participant in the chain, and governors works together tightly.

The literature review shows knowledges of international trade, supply chain management and its relevant learning, and supply chain finance. The review of international trade aims to study the factors that needs to figure out how countries do business with another. Moreover, international trade theory helps to make sure about the agricultural product trade is practicable and valuable between Thailand and China, and the business benefits both countries.

The reviews of supply chain management lead to a knowledge of management which runs through coordination. According to scholars that research on the area of supply chain, author knows that supply chain exists on most place in business. The knowledge provides a way to improve the business by some dimensions. This research combines trade with supply chain and defines a view of trade supply chain. Also, agricultural product is an important objective in this research, therefore, Thai and Chinese agricultural product supply chain should be reviewed. Supply chain performance is one of main knowledge in this research, especially SCOR model. The model offers performance attributes for the research, and this is the theoretical reference in the study of cost and time.

The research believes game theory also needs to be concerned. The theory can provide motivation of participants in the APTSC between Thailand and China, which can answer to the questions such as why the participant makes the decision? Also, the theory proofs the optimized APTSC can be accepted by participants in the APTSC.

Financial products/services aim to help enterprises funding for surviving in the business. The author believes the products which combines finance and supply chain can be the best solution for every party in the APTSC. Especially, supply chain finance works on serve SMEs (Caniato et al., 2019).

CHAPTER III

RESEARCH METHODOLOGY

This chapter provides a brief overview of the research methodology. The proposed methodologies for the research include utilizing bibliometrics through CiteSpace and employing system dynamics modeling using Vensim. These methodologies are expected to generate results that will be discussed in the study, ultimately leading to the formulation of recommendations aligned with the research objectives.

Workflow

Figure 13 shows the whole workflow from start to conclusion. The research began by introducing the background and problems in the area of agricultural trade between Thailand and China in order to establish the research objectives. A literature review was conducted on relevant research pertaining to agricultural product supply chains and trade supply chains to identify gaps in the current knowledge. The review revealed a lack of research on agricultural product trading supply chains, prompting the use of bibliometric analysis through CiteSpace to make an observation into an research area of agricultural trade supply chain. This analysis indicated that system dynamics would be a suitable method to study supply chain management and financial supply chains in this context. The proposed methodologies for the research therefore include bibliometrics through CiteSpace and system dynamics modeling using Vensim. The research would then produce results that would be discussed to provide recommendations considering the objectives.

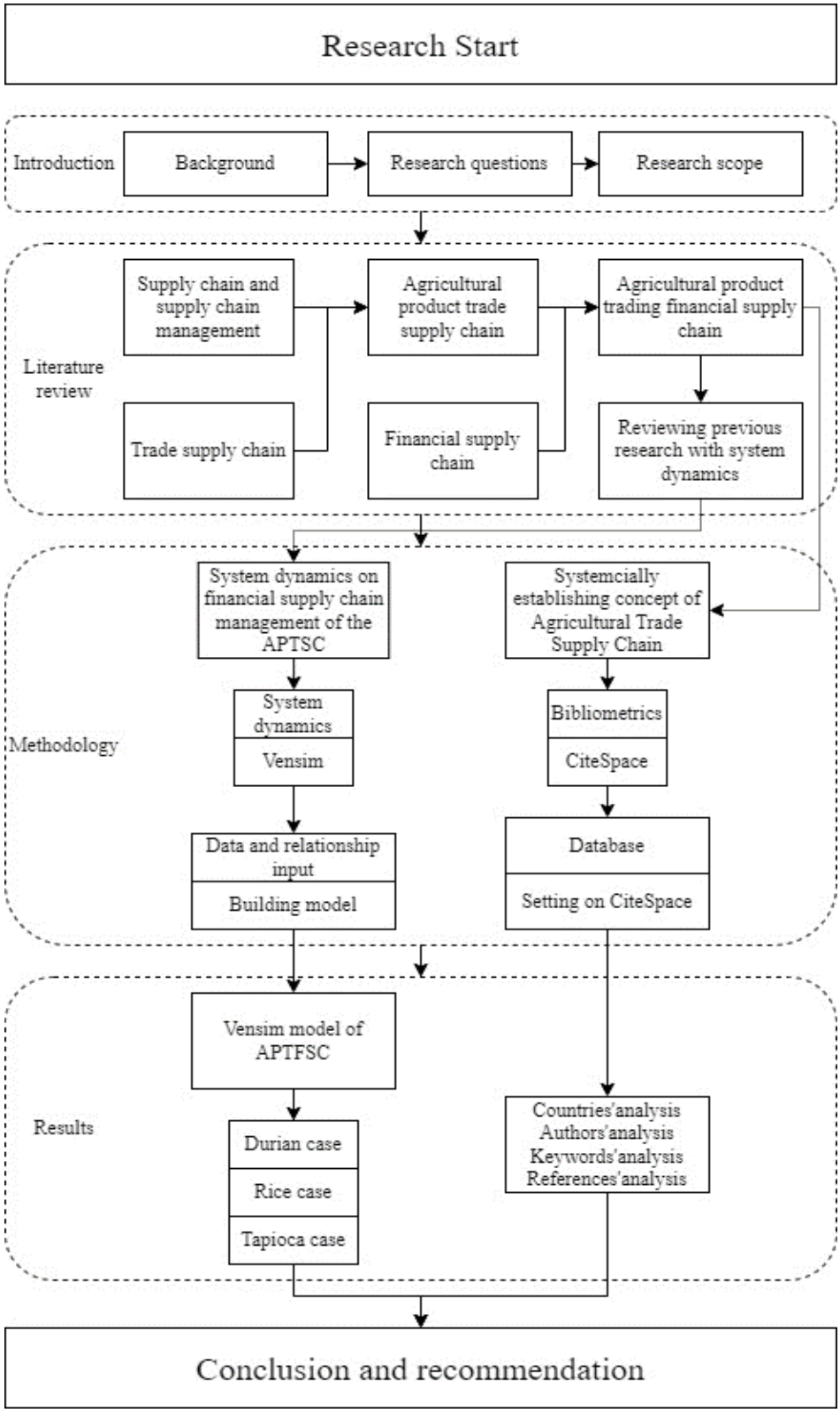


Figure 13 Workflow

Bibliometrics

Bibliometrics is a subfield of library and information science concerned with the quantitative analysis of bibliographic data, also known as citation analysis or scient metrics. It emerged as a distinct field in the 1960s and has since been used to measure the impact of scholarly publications, authors, and journals. Bibliometric analyses have become increasingly popular in recent years, with the growing importance of research assessment and evaluation.

One of the main uses of bibliometrics is to measure the impact of scholarly publications, which can be done using various indicators such as citation counts, h-index, and impact factor. Citation counts are simply the number of times a publication has been cited by other articles, and are often used to determine the level of influence a particular author or article has had on their field. The h-index is another commonly used indicator, which takes into account both the number of publications and their citation counts. Finally, the impact factor is a metric used to evaluate journals based on the average number of citations received by articles published in that journal over a specified period of time.

One of the challenges of bibliometrics is that it relies on the accuracy and completeness of citation data, which can vary depending on the source and the methodology used. For example, some databases may not include all relevant publications or may include duplicates, which can distort the results of bibliometric analyses. Additionally, different fields of research may have different citation practices, with some disciplines placing more emphasis on book chapters or conference proceedings rather than journal articles. Despite these limitations, bibliometrics remains a valuable tool for evaluating research impact and informing research policy.

Another area where bibliometrics is widely used is in the evaluation of research institutions and funding agencies. Governments and other funders often use bibliometric indicators to assess the quality and impact of research output when allocating grants and other resources. Similarly, universities and research centers may use bibliometric analyses to identify areas of strength or weakness in their research portfolios, and to benchmark their performance against other institutions.

However, bibliometrics has been criticized for its overreliance on quantitative data at the expense of qualitative evaluation. Some have argued that citation-based metrics may not provide a complete picture of research impact, as they do not take into account factors such as societal relevance or the practical applications of research findings. Additionally, some researchers may engage in self-citation or citation cartels in order to boost their citation counts, which can distort the results of bibliometric analyses. Furthermore, bibliometrics may not capture emerging areas of research that have not yet generated significant citation activity.

Despite these criticisms, bibliometric analyses continue to be widely used in research assessment and evaluation. However, it is important to use caution when interpreting bibliometric data, and to supplement this approach with other methods of evaluation such as peer review and expert assessment.

In previous research, bibliometrics has been widely used in various fields of research through various methods. Leydesdorff and Vaughan (2006) used neural network analysis and combined it with bibliometrics, it is possible to effectively identify key clusters in the field of research and visualize the relationships between these clusters.

In conclusion, bibliometrics has become an important tool for evaluating research impact and informing research policy. While it has some limitations and drawbacks, it remains a valuable complement to other methods of evaluation and will likely continue to play a prominent role in research assessment and evaluation in the years to come.

1. Reviewing research with using CiteSpace

Our research necessitates the utilization of a visual document analysis tool. CiteSpace, widely used in the medical field for review articles through methods such as reference analysis, cited authors analysis, cluster analysis, and centrality analysis (Liang et al., 2018), will be invaluable in assisting us with the abundant data we have collected on identifying needs (Chen, 2017). CiteSpace generates an article evaluation encompassing authorship, countries, institutions, keywords, reference articles, and reference journals, offering insights into current hotspots, main contributions, and future trends within the e-commerce research field (Mou et al., 2019). In addition to providing the map, CiteSpace facilitates data analysis beyond human perception,

including cluster and centrality analyses (Chen, 2014). While its contributions to the medical field may have waned in recent years, CiteSpace continues to find application in other fields, such as supply chain risk, where it provides researchers with a comprehensive knowledge framework encompassing authors, institutions, keywords, research hotspots, and co-cited literature (Sun et al., 2020). For example, Guan et al. (2020) summarized the hot issues and research trends of the closed-loop supply chain using CiteSpace. Additionally, Zeng and Hengsadeekul (2020) identified that sustainable supply chains may support organizations and stakeholders in environmental issues. As a scientifically appropriate tool for bibliometrics extensively used by scholars, CiteSpace's results are generally deemed acceptable. Therefore, we will use CiteSpace to review the ATSC.

2. Database

Web of Science, formerly known as the Web of Knowledge, is an online subscription-based scientific citation indexing service developed by Clarivate Analytics. It gives access to multiple interlinked databases that reference cross-disciplinary research, allowing for in-depth exploration of related scholarly literature.

The main Web of Science databases cover over 12,000 notable journals across the sciences, social sciences, arts, and humanities. Some key databases are:

- Science Citation Index Expanded covering over 8,500 journals in the sciences from 1900 onward.
- Social Sciences Citation Index covering over 3,000 journals in the social sciences from 1956.
- Arts and Humanities Citation Index covering over 1,700 journals in the arts and humanities from 1975.
- Conference Proceedings Citation Index indexing conference proceedings in science, technology, and humanities from 1990.
- Emerging Sources Citation Index covering over 8,000 open access journals across various fields like life sciences, social sciences, and arts.

Web of Science provides powerful tools for researchers:

- The "citation map" shows works cited by or citing an article, allowing researchers to visualize how their work fits into the scholarly landscape.
- "Times cited" data indicates an article's scholarly impact. Highly cited

papers denote influential research.

• Bibliometric data reveals trends and strengths in research output by subject area, institution, country, and more.

Web of Science has been called "the gold standard for citation databases" due to its comprehensive scope and rigorous editorial processes. Newsweek described it as "the researchers' first choice," noting that journal selection involves "meticulous vetting" through a highly selective editorial review. Scientists at Stanford called Web of Science "the most comprehensive citation index," covering 2.5 times more articles from top journals than other databases. Publishers and funders also value Web of Science data for evaluating journal impact factors and granting funding based on citation metrics. The interface allows limiting searches by document type, language, author, publication name, and more. Results can integrate findings across databases while eliminating duplicates. Links to library subscriptions grant access to full texts, and data can export to reference managers. The Create Alert feature notifies users of new content relevant to their interests, helping keep up with emerging developments. Web of Science has been praised for its easy-to-use interface and powerful visualization tools that help reveal patterns, trends, and outliers in the data. It integrates with other research tools for a seamless research experience.

In summary, for comprehensiveness, rigorous standards, citation metrics, visualization tools, and integration with the wider research ecosystem, Web of Science remains an indispensable resource for exploring influential research across the spectrum of academic knowledge. Its unparalleled scope and breadth, coupled with robust analysis features, empower researchers seeking to uncover discoveries and make new connections.

The present study focuses on the selection of WOS database, specifically Social Sciences Citation Index (SSCI) and Science Citation Index Expanded (SCI-EXPANDED) and examines their relevance to the topic of Agricultural Trade Supply Chain (ATSC). Due to the prolonged duration of the research, we conducted one analysis from 2012 to 2021 in 2022, as of July 27, 2022, the research yielded a total of 652 pertinent scientific papers on ATSC. And another analysis from 2013 to 2022 in 2023. As of March 14, 2023. The first analysis contained the keywords "Agricultural trade supply chain", while the second analysis built upon the original keywords by

adding the keywords "Sustainability OR Sustainable".

In this study, we will use the acronym ATSC to refer to this topic throughout the following sections.

3. Setting on CiteSpace

Upon importing the database into CiteSpace version 6.1.R2, we selected various node types such as Author, Institution, Country, Keyword, Reference, and Cited Author, respectively.

Additionally, we set the Time Slicing to 2012 Jan - 2021 Dec with a Years Per Slice of 1 for the first time, and the Time Slicing is set to 2013 Jan to 2022 Dec, and the Years Per Slice is 1 for the second time. For Text Processing, we chose title, abstract, author keywords (DE), and keywords plus (ID).

In CiteSpace, there are seven node types available: Author, Institution, Country, Keyword, Reference, Cited Author, and Cited Journal. The resulting output for each node type typically includes Count, Centrality, Year, and the respective node type element. Count refers to the frequency at which an event or occurrence happens, such as the number of published papers for a country or the number of keywords mentioned in a database. Nodes on the map in CiteSpace are connected by one or more lines, and nodes with greater connectivity represent significant nodes quantified by centrality (Zeng & Hengsadeekul, 2020). CiteSpace generates a map for each analysis under the chosen node type, where the size of the node is proportional to the count. The outer purple circle displayed around a node indicates a centrality value greater than 0.10, with bigger nodes representing higher counts and thicker purple circles indicating larger centralities.

System Dynamic

1. System

In general, a system can be defined as a collection of interrelated or interconnected components that work together to achieve a common goal or purpose. These components can be physical, conceptual, or abstract, and they interact with each other in a predictable manner to produce a particular output or behavior.

Systems can be found in various forms and at different levels of complexity, from simple mechanical devices to complex social, economic, or ecological systems. They are used in numerous fields, including engineering, biology, physics, management, computer science, and many others.

One of the defining features of a system is its structure, which refers to the way its components are organized and arranged relative to one another. The structure of a system can varies depending on its function, design, and intended use. For example, a car engine is a system that consists of multiple components such as pistons, crankshafts, and valves, all arranged in a specific way to convert fuel into energy and propel the vehicle forward.

Another important aspect of systems is their behavior, which describes how they operate or respond to inputs or changes in their environment. A system's behavior can be described mathematically or graphically using models or simulations. By analyzing a system's behavior, engineers, scientists, and other experts can optimize its performance or predict how it will behave under different conditions.

A key concept in systems theory is feedback, which refers to the process by which a system receives information about its own performance and adjusts its behavior accordingly. Feedback can be positive or negative, depending on whether it reinforces or dampens the system's output. For example, a thermostat is a simple feedback system that maintains a constant temperature by sensing the room temperature and adjusting the heating or cooling as needed.

Systems thinking is a holistic approach to understanding and managing complex systems. It involves looking at the bigger picture and understanding how different parts of a system are interconnected and interdependent. Systems thinking also emphasizes the importance of considering the long-term effects of decisions and actions, rather than just focusing on short-term goals or outcomes.

In conclusion, a system is a collection of interconnected components that work together to achieve a common goal or purpose. Systems can be found in various forms and at different levels of complexity, and they are used in numerous fields to solve problems, optimize performance, or predict behavior. Understanding systems and applying systems thinking can help us better understand the world around us and make more informed decisions.

2. System dynamic

System dynamics is a framework for understanding complex systems and the ways in which they change over time. It was developed by Jay Forrester at the Massachusetts Institute of Technology (MIT) in the 1950s as a way to study the behavior of industrial processes but has since been applied to a wide range of fields such as economics, ecology, healthcare, and social systems. The origins of system dynamics can be traced back to cybernetics and feedback control theory, which were popular in the mid-20th century.

The fundamental notions of system dynamics revolve around understanding how different parts of a system interact with each other and how these interactions give rise to behavior over time. Some key concepts in system dynamics include:

1. Stocks and flows: A stock represents something that accumulates or depletes over time, such as the amount of water in a reservoir or the number of people in a population. Flows represent the rates at which things enter or leave a stock, such as the inflow and outflow of water from a reservoir.

2. Feedback loops: Feedback loops represent how changes in one part of a system affect other parts of the system, which in turn affect the original part. There are two types of feedback loops: reinforcing loops, which amplify change and create exponential growth or decline, and balancing loops, which stabilize a system and prevent runaway growth or decline.

3. Delays: Delays represent the time it takes for a system to respond to changes. Understanding delays is important because they can cause unexpected or counterintuitive behavior, such as when a policy intended to solve a problem ends up making it worse.

4. Causal relationships: Causal relationships represent the links between different parts of a system and the ways in which they influence each other. Understanding causal relationships is essential for identifying leverage points in a system where small changes can have large effects.

As mentioned earlier, system dynamics has its roots in cybernetics and feedback control theory. Cybernetics was an interdisciplinary field that emerged in the 1940s and aimed to understand how organisms, machines, and social systems regulate themselves. Feedback control theory, which was developed in the same period, was

concerned with designing systems that could maintain stable conditions even in the face of disturbances.

Jay Forrester, a professor of electrical engineering at MIT, became interested in applying these ideas to industrial management and founded the System Dynamics Group at MIT in 1956. Forrester and his colleagues used computer simulations to model the behavior of complex systems such as factories, urban transportation networks, and resource depletion. They found that simple policies intended to address problems like traffic congestion or pollution often had unintended consequences, such as causing more congestion or pollution in the long run.

Forrester's work on system dynamics gained prominence in the 1960s and 1970s, and he published several influential books, including "Industrial Dynamics" (1961) and "World Dynamics" (1971). System dynamics also became popular in business management, with companies using it to model supply chains, inventory management, and product development.

In conclusion, system dynamics is a powerful framework for understanding complex systems and their behavior over time. Its origins lie in cybernetics and feedback control theory, and it has since been applied to a wide range of fields. The fundamental notions of system dynamics include stocks and flows, feedback loops, delays, and causal relationships. Understanding these concepts is essential for identifying leverage points in a system and developing effective policies that avoid unintended consequences.

3. Application of system dynamics with Vensim

System dynamics is a modeling technique used to understand complex systems, which are characterized by feedback loops and nonlinear relationships. It originated in the 1950s with the work of Jay Forrester and has since been applied in various fields ranging from engineering, management, and social sciences. In the academic field, system dynamics has become increasingly popular due to its advantages, some of which are discussed below.

Firstly, system dynamics allows researchers to capture the dynamic behavior of complex systems. Unlike traditional models that assume linear relationships, system dynamics makes it possible to model complex systems with nonlinear connections, delays, and feedback loops. This ability to capture the dynamics

of complex systems helps to generate insights on how different variables interact over time, thereby aiding the development of more effective policies and strategies. Secondly, system dynamics facilitates the identification of critical feedback loops driving system behavior. The technique allows researchers to identify feedback loops that amplify or dampen the impact of different variables, thereby highlighting key leverage points for intervention. By identifying these critical feedback loops, researchers can develop policies and strategies that target these leverage points for maximum impact. Thirdly, system dynamics aids in scenario analysis and testing. Researchers can use the technique to simulate different scenarios and test the impact of policy interventions under different conditions. This ability to test policies in a virtual environment before implementation can help to save time and resources while improving decision-making. Fourthly, system dynamics provides a transparent platform for communication and collaboration among stakeholders. The visual nature of system dynamics models makes it easy for researchers to communicate their findings to stakeholders in a clear and understandable way. This transparency promotes collaboration and can build consensus among stakeholders around policies and strategies. Lastly, system dynamics promotes learning and continuous improvement. The iterative nature of system dynamics modeling means that researchers can refine their models based on new data or feedback from stakeholders. This continual refinement helps to improve the accuracy of the model over time and leads to better decision-making.

There are numerous cases of system dynamics application in the academic field. Some of these include:

1. The application of system dynamics to understand the dynamics of infectious diseases such as HIV/AIDS, malaria, and tuberculosis (Mwangi, 2016).

2. The use of system dynamics to model the impact of climate change on natural resource management (Turner et al., 2016).

3. The application of system dynamics to improve health care delivery systems (Davahli et al., 2020).

4. The use of system dynamics to inform policy development in areas such as education, public transportation, and urban planning(Faham et al., 2017; Fong et al., 2009; Shepherd, 2014).

5. The application of system dynamics to understand the dynamics of financial markets and economic systems (McCAULEY & Küffner, 2004; Mohammadi & Pashootanizadeh, 2017).

The VENSIM software is a powerful tool for system dynamics modeling that offers several advantages to researchers in the academic field. Some of these advantages are discussed below.

Firstly, VENSIM provides an intuitive interface for developing complex system dynamics models. The software uses a visual interface to allow researchers to develop models quickly and easily, even for large and complex systems. Secondly, VENSIM supports sensitivity analysis and optimization. Researchers can use the software to test the impact of different assumptions and parameters on the model output, thereby improving the accuracy and robustness of the model. Thirdly, VENSIM allows for real-time simulation and scenario testing. Researchers can use the software to test the impact of policy interventions under different scenarios, thereby aiding decision-making. Fourthly, VENSIM supports collaboration and communication among stakeholders. The software allows researchers to share models with stakeholders in a clear and understandable way, thereby promoting collaboration and building consensus around policies and strategies. Lastly, VENSIM supports learning and continuous improvement. The software allows researchers to refine their models based on new data or feedback from stakeholders, thereby improving the accuracy and relevance of the model over time.

There are numerous cases of VENSIM application in the academic field. Some of these include:

1. The use of VENSIM to model the dynamics of infectious diseases such as COVID-19 (Sinha et al., 2020).

2. The application of VENSIM to understand the impact of climate change on water resources in California (Olabisi et al., 2018).

3. The use of VENSIM to investigate the impact of policy interventions on health care delivery systems in Chile (Hosseinzadeh et al., 2022).

4. The application of VENSIM to model the dynamics of urban transportation systems in China (Jifeng et al., 2008).

5. The use of VENSIM to simulate the behavior of financial markets and economic systems (Kovalevsky, 2016).

In conclusion, VENSIM are powerful tools that offer several advantages to researchers in the academic field. These tools have been used in numerous applications to improve our understanding of complex systems and aid decision-making across various fields. As such, they hold immense potential for future research in the academic field.

1. The connection

System Dynamics is a research methodology that views the object of study as a system consisting of interconnected components. To describe the structure of a system, it is crucial to outline the relationships between its components. System Dynamics uses a visual approach called the causal relationship graphic method, which shows cause-and-effect relationships between system components. In the Figure 14, an arrow represents the direction of causality, where the tail denotes the cause and the head signifies the effect. A positive sign near the arrow indicates that the cause and effect variables change in the same direction (i.e., synthetic connection), while a negative sign denotes that they change in opposite directions (i.e., reverse connection). Although system connections can be complex mathematical expressions, synthetic and reverse connections are the fundamental elements of system structure.

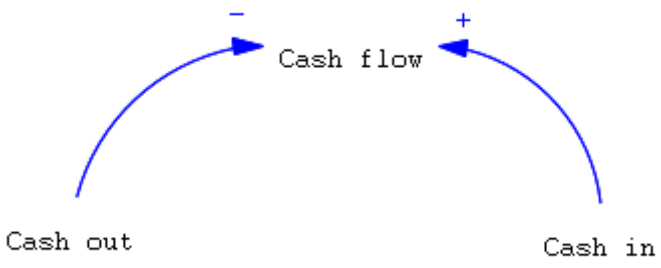


Figure 14 Connection of system components

2. Feedback loop and system

In the system, if some of the factors connected together end to end to form a ‘close loop’, as shown below the Figure 15.

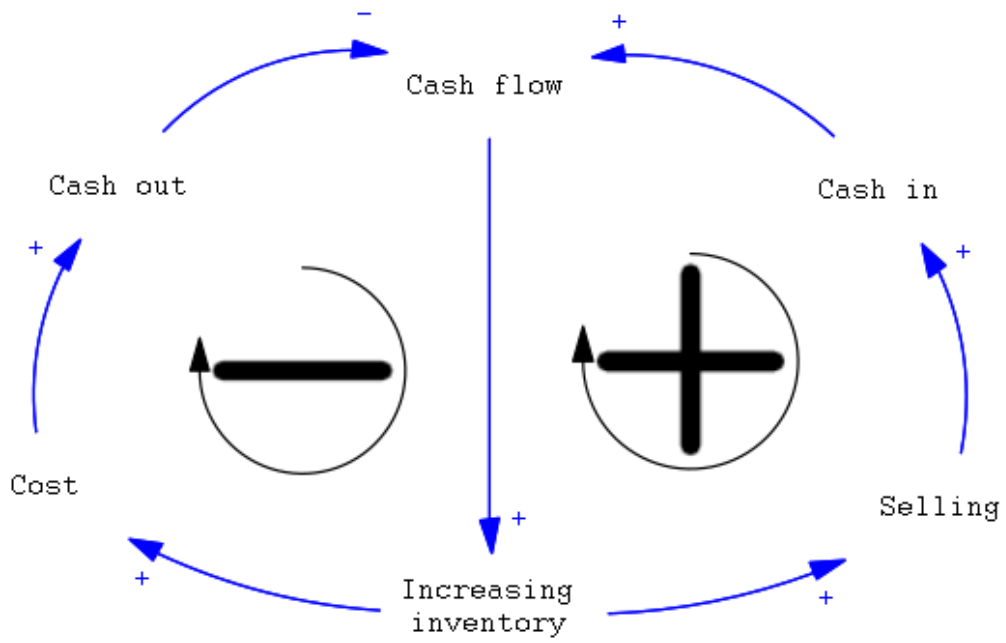


Figure 15 Positive and negative feedback loops

Feedback refers to the relationship between output and input within the same unit or sub-block of a system, where the output of a unit transforms and feeds back into the input of the next period. A feedback loop is formed when a feedback relationship exists in a connection, creating a closed loop around the unit, also known as a causal loop. A system with feedback relationships is referred to as a feedback or closed-loop system, while a system without feedback relations is called an open-loop system. Feedback systems can exhibit various dynamic behaviors determined by their internal structure, whereas open-loop systems are primarily influenced by external factors. Social and economic systems, which show inherent dynamic behavior, are typically feedback systems. System Dynamics is a discipline that studies feedback systems, which always include at least one feedback loop. Feedback loops within a system are interconnected, forming a complex system structure. System Dynamics employs feedback loops as basic units to describe the system structure. In complex systems, a

key feedback loop has a leading function in influencing system behavior. The primary goal of System Dynamics modeling is to uncover the key feedback loop and assist in real-world applications. Depending on characteristics of feedback loop, there are positive and negative feedback loops. A positive feedback loop occurs when all the connections in a loop are of the same direction or when the reverse connections involve an even number of factors. Conversely, a negative feedback loop occurs when the reverse connections involve an odd number of factors.

3. Casual loop setting

Figure 16 shows a casual loop of that can be divided into two main flows: material flow and cash flow. In terms of material flow, there is a positive correlation between the volume delivered to downstream and orders from end markets. Changes in the volume of agricultural products delivered to downstream affect selling forecasts among all participants in the chain, which must be considered alongside average delivery time. Selling forecast and expected inventory duration impact the expected inventory of every participant, which in turn affects orders to upstream with inventory adjustment time. The volume of deliver from upstream, considering the factor of delay, is the order to upstream. Delay also influences the delivery to downstream. In terms of cash flow, agricultural products delivered to downstream are exchanged for cash, which is the "cash in" of the cash flow. A portion of this cash covers the material procurement cost at an assumed average cost. Procurement cost and inventory cost impact the "cash out" of the cash flow, with inventory cost affected by expected inventory duration, average inventory cost, and actual inventory. Cash flow is the difference between "cash in" and "cash out," which significantly impacts inventory. Two causal loops exist in this agricultural product trade supply chain: one in material flows and one in cash flows. Inventory, number of agricultural products delivered to downstream, selling forecast, expected inventory, order to upstream (number of agricultural products), and deliver from upstream (number of agricultural products) form a positive feedback loop in material flow, with changes in these factors affecting other factors positively. In cash flows, there is a positive and negative feedback loop. When agricultural products are delivered to downstream, upstream receives cash equivalents as the selling price or procurement cost, which is "cash in" and is positive to the cash flow. "Cash out," which is negative to cash flow, consists of procurement cost and inventory cost. Continuously

increasing cash flow encourages participants to spend more on payout, such as reinvestment in inventory. Hence, cash flow is a positive factor for inventory.

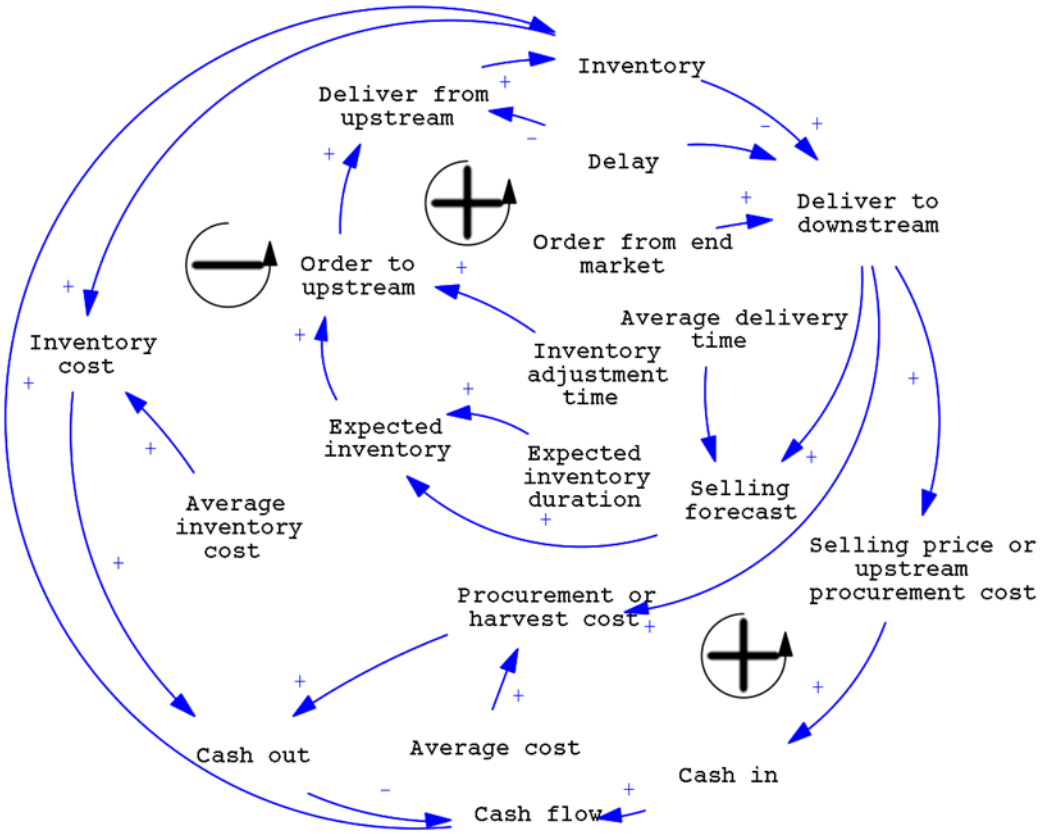


Figure 16 Casual loop of the APTFSC

4. Variables setting

The agricultural product trade supply chain involves material flow and cash flow. The former can be represented by eleven variables, including inventory, flow in rate, flow out rate, order, selling forecast, expected inventory, delay, expected inventory duration, average delivery time, inventory adjustment time and agricultural product demand in the Table 2. Inventory is a state variable that represents the difference between flow in rate and flow out rate, while flow in rate and flow out rate are flow variables that indicate the number of agricultural products delivered to downstream or upstream. Due to the scope of this model, the post-harvest and selling rates represent

the flow in rate and flow out rate, respectively. Selling price and demand are used to represent the end of material flow, with the latter set at 1,000,000 kg per day. Auxiliary variables include order, selling forecast, and expected inventory, which are affected by other variables and expressed mathematically using state variables, flow variables, and constants. Order has been represented by a formula which calculates an order quantity for a product, considering forecasted sales and inventory levels. The order quantity will be zero if the calculation result is negative. It also takes into account the adjustment time for inventory changes and the company's cash flow. Finally, it uses the cash flow data from seven days ago as a reference point. In addition, four constant variables based on literature reviews or assumptions are included. Delay is divided into harvest delay and transport delay, with the former occurring before farmers collect agricultural products into their inventory, and the latter impacting the delivery rate from farmers to trading manufacturers and from trading manufacturers to distributors. The model assumes a harvest delay of two days and a transport delay of three days due to unofficial interviews with trading business practitioners. Expected inventory duration is assumed to be one day, and average delivery time is set at seven days due to the perishable nature of agricultural products. Overall, this model provides a comprehensive understanding of the agricultural product trade supply chain and its various components, which can be useful for analyzing potential areas for improvement and optimization.

Table 3 Variables in material flow

Variables	Variable type	Mathematical expression
Inventory	State variable	$Inventory = INTEG(Flow\ in\ rate - Flow\ out\ rate, Initial\ value = 10000)$
Flow in rate	Flow variable	$Flow\ in\ rate = DELAY(Order, Delay)$
Flow out rate	Flow variable	$Flow\ out\ rate = DELAY(Order, Delay)$ $Selling\ rate = Agricultural\ product\ demand$

Variables	Variable type	Mathematical expression
Order	Auxiliary variable	$Order = MAX(0, \left(Selling\ forecast + \frac{Expected\ inventory - Inventory}{Inventory\ adjustment\ time}\right) * \frac{Cash\ flow}{DELAY1(Cash\ flow, 7)})$
Selling forecast	Auxiliary variable	$Selling\ forecast = SMOOTH(Flow\ out\ rate, Average\ delivery\ time)$
Expected inventory	Auxiliary variable	$Expected\ inventory = Expected\ inventory\ duration * Selling\ forecast$
Delay	Constant	$Harvest\ delay = 2\ ;\ Transport\ delay = 3$
Expected inventory duration	Constant	$Expected\ inventory\ duration = 1$
Average delivery time	Constant	$Average\ delivery\ time = 7$
Inventory adjustment time	Constant	$Invenotry\ adjustment\ time = 3$
Agricultural product demand	Constant	$Agricultural\ product\ demand = 1{,}000{,}000$

Similar to material flow, which is shown in Table 3, cash flow also consists of state variables, flow variables, auxiliary variables, and constants. We set the units of all variables to be Yuan. For example, all participants' initial cash flows are 10,000 YUAN. The cash flow equation integrates the difference between cash inflows and outflows over time, starting with an initial value, to represent the stock of cash available. The cash in rate is simply defined as the procurement cost, meaning cash comes in from spending on procuring raw materials and inputs. The cash out rate sums the major cash outflows - procurement, inventory costs, and manufacturer's trading outflows. Manufacturing trading outflows include procurement costs, inventory costs,

and tariffs on cash inflows. The procurement cost calculates the total expenditure on procurement by multiplying order quantity by the unit cost. The inventory cost calculates inventory expenditure by multiplying amount of inventory by the unit holding cost. The average procurement cost calculates the unit cost of procurement from downstream partners by taking their average cost and adjusting for the profit margin they take. The average inventory cost is a constant unit cost for holding inventory. The selling price is a fixed price at which the product is sold. The average profit is a fixed percentage representing the profit margin. The fluctuations in exchange rate are set to 1, presumably to model potential exchange rate changes. The tariff rate is a fixed percentage tariff on cash inflows.

The state variable for cash flow is the difference between cash in rate and cash out rate, which is expressed mathematically as an integral. The initial cash values for all participants are assumed to be ten thousand, and each participant must pay for flow-in durians while receiving payment for flow-out durians. Cash out rate is a flow variable that includes procurement cost (harvest cost for farmers) and inventory cost. Cash in rate is determined by the procurement cost of downstream participants, while distributors' cash in rate is based on selling price. Two constants, namely average procurement cost and average inventory cost, are included to express procurement and inventory costs intuitively. Procurement cost is calculated by multiplying order with the average procurement cost, while inventory cost is determined by multiplying actual inventory with the average inventory cost. This model provides a clear understanding of the cash flow aspects of the agricultural product trade supply chain. By analyzing these variables, we can gain insights into potential ways to optimize cash flow and improve the overall efficiency of the supply chain.

In summary, the expressions follow logical calculations to model the components of cash inflows and outflows based on quantities, unit costs, and fixed parameters. The structure represents the basic dynamics of a cash flow system.

Table 4 Variables in cash flow

Variables	Variable type	Mathematical expression
Cash flow	State variable	$Cash\ flow = INTEG(Cash\ in\ rate - Cash\ out\ rate, Initial\ value = 10000)$
Cash out rate	Flow variable	$Cash\ out\ rate = Harvest\ or\ Procurement\ cost + Inventory\ cost$ $Trading\ manufacturers\ cash\ out = Inventory\ cost + Procurement\ cost + cash\ in * Tariff$
Cash in rate	Flow variable	$Cash\ in\ rate = Precurement\ cost$
Procurement cost	Auxiliary variable	$Procurement\ cost = Order * Average\ procurement\ cost$
Inventory cost	Auxiliary variable	$Inventory\ cost = Inventory * Average\ inventory\ cost$
Average procurement cost	Auxiliary variable	$Average\ procurement\ cost = Average\ procurement\ cost\ of\ downstream * (1 - Average\ profit)$
Average inventory cost	Constant	$Average\ inventory\ cost = 1$
Selling price	Auxiliary variable	$Selling\ price = 30{,}000$
Average profit	Constant	$Average\ profit = 20\%$
Fluctuations in exchange rate	Constant	$Flutuations\ in\ exchange\ rate = 1$
Tariff rate	Constant	$Tariff = 1\%$

5. Flow map setting

The APTFSC, which stands for agricultural product trading financial supply chain, was modeled using Vensim. The model represents the daily change of material and cash flows of Thai agricultural products exported to China over a period of 720 days. The mathematical expressions and constants used in the model were set according to Table 1 and Table 2, while Figure 13 illustrates the causal flow of the APTFSC.

The selling rate, which is determined by Chinese demand for agricultural products, serves as the starting point of the model. For the purposes of the model, it was assumed that the minimum volume of exports from Thailand to China was 0 per day, the maximum was 4000, and the median was 350. The initial value was set to the average value, which was 800. A random variable of agricultural product demand was also included in the model. In the model, distributors' selling forecasts are based on the selling rate, after considering the average delivery time, and their expected inventory with expected inventory duration. Distributors' orders are determined by combining selling forecasts, expected inventory, actual inventory, and inventory adjustment time. This information is then used to calculate the processed agricultural product delivery rate. This same process is repeated for trading manufacturers and farmers. As the agricultural products flow, so do the cash flows. The distributors' cash inflow is obtained by multiplying the selling price by the selling rate, while the cash outflow is calculated by subtracting procurement cost and inventory cost. Procurement cost, in turn, is the cash inflow of trading manufacturers, and this same process applies to farmers. The procurement cost and inventory cost can be obtained by extracting data from the material flow and multiplying it by the assumed average procurement cost and average inventory cost. Figure 17 presents a model flow diagram of the APTFSC from Thailand to China. In addition, the model considers tariffs rate and exchange rate fluctuations as significant factors influencing international trade. The income of trading manufacturers has a direct impact on the exchange rate since distributors typically do not transact in the same currency as farmers. Tariffs rates affect the spending of trade manufacturers exclusively, as they are the only ones obligated to pay them.

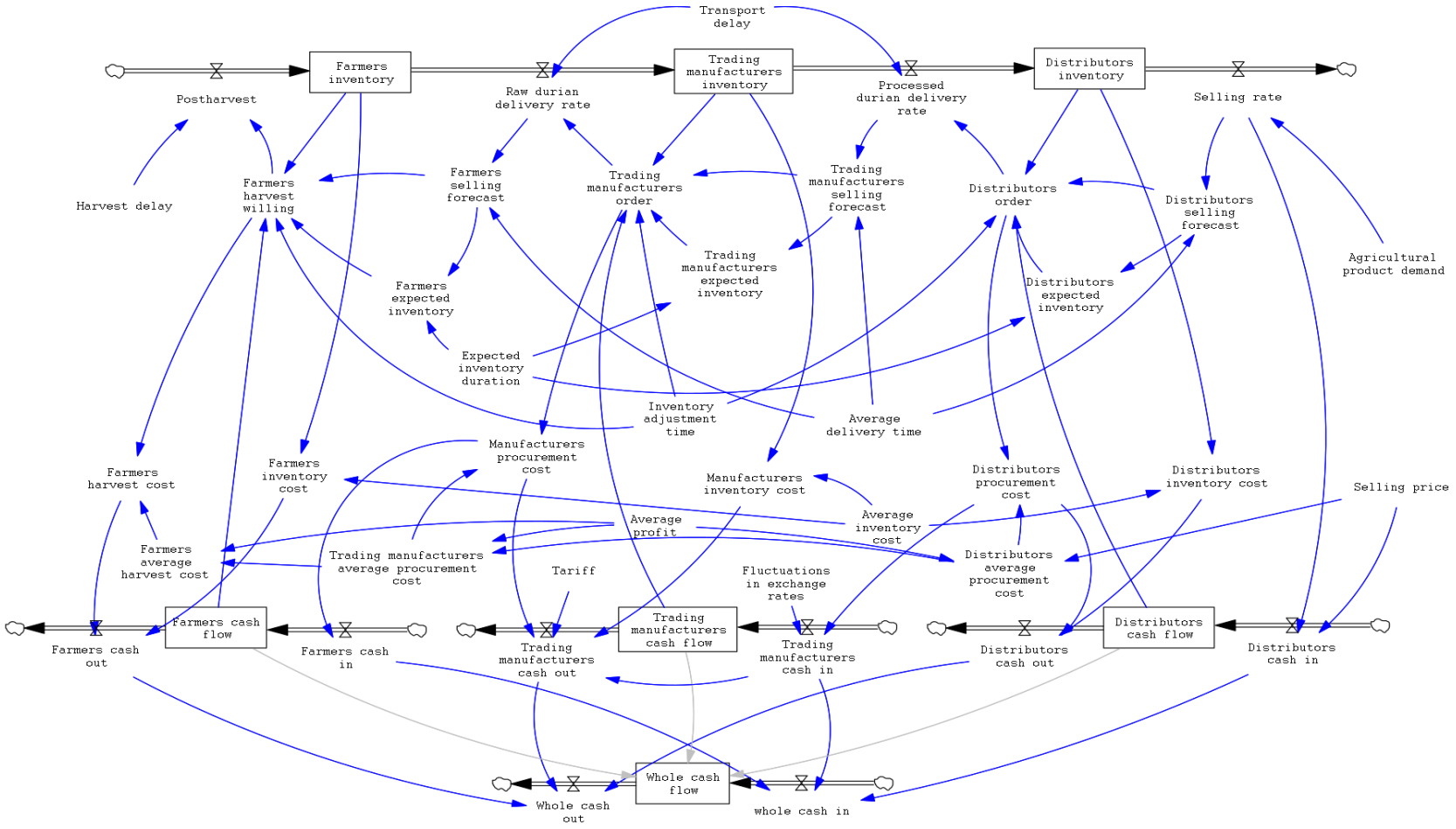


Figure 17 Flow diagram of material flow and cash flow in the APTFSC

In addition, since the model should be able to be applied to the trade of specific agricultural products, and different agricultural products require different variables in the process of trade, the model will be generated three times to show the actual situation of the three most representative agricultural products. We display the values or expressions of tariffs, demand, and selling prices for three agricultural products in Table 4.

According to the customs of the People's Republic of China and the relevant government agency in Thailand, there is a preferential tariff agreement between China and Thailand on durian. In 2020, China and Thailand signed the China-Thailand Free Trade Agreement upgrade protocol, which included the reduction or elimination of tariffs on various products, including durian. Under the FTA, China has agreed to eliminate tariffs on fresh durian and frozen durian with no added sugar, while Thailand will reduce tariffs on certain Chinese products. The tariff reduction for durian from Thailand to China began in October 2020, the tariffs on fresh durian and frozen durian with no added sugar are expected to be fully eliminated. Therefore, Tariffs rate in the durian trade supply chain will be assumed to be 0; Due to the China-ASEAN Free Trade Area agreement and the zero-tariff treatment between Thailand and China, tariff of rice trade can be considered as 0. However, China does have a tariff-rate quota (TRQ) system in place for importing rice, which allows a certain amount of rice to be imported at a lower tariff rate, while quantities above the TRQ are subject to higher tariffs. The TRQ for rice in 2023 is set at 5.32 million tons. According to the notice from the Customs Tariff Commission of the State Council on the 2022 tariff adjustment plan, the tax rate for rice exported to China within the quota is 1%. However, if the quota is exceeded, the tax rate will increase to 65%. In this study, we set the tax rate for rice in the first 180 days of every 365 days to 1%, and the tax rate for rice in the remaining days to 65%; From the Ministry of Commerce of the State Council of the People's Republic of China, we learned that the average tax rate for tapioca exported to China is around 13%. Therefore, in the case of tapioca, we will set the tariff at 13%.

For the demand of durian, according to the data obtained from China Customs, from 2017 to 2021, the amount of Thai durian exported to China were 270,000 tons, 280,000 tons, 300,000 tons, 120,000 tons, and 200,000 tons respectively. Given the outbreak of COVID-19 in early 2020, we only refer to the data from 2017 to

2019 and assume that Thailand sells 300,000 tons of durian to China annually. After simple calculations, we assume that the daily demand for Thai durian in China is around 800 tons in our model; According to the data released by China Customs, from 2017 to 2021, the amount of rice exported from Thailand to China were 418,000 tons, 279,000 tons, 222,000 tons, 224,000 tons, and 214,000 tons respectively. Therefore, we assume that Thailand sells 220,000 tons of rice to China annually, which translates to a daily amount of 600 tons; According to the data released by China Customs, from 2017 to 2021, the average annual amount of tapioca exported from Thailand to China was around 10 to 11 thousand tons, with the specific amounts being approximately 106,000 tons in 2017, 104,000 tons in 2018, 111,000 tons in 2019, 112,000 tons in 2020, and 113,000 tons in 2021. Assuming that tapioca sells 110,000 tons annually in China, which averages to 300 tons per day.

About selling price, according to the data spanning from 2019 to 2022, Thailand has exported an average of approximately RMB 3.8 billion worth of durians to China annually, with an average tonnage of about 90,000 tons per year. Consequently, the export price of Thai durians to China is estimated at around USD 4,222.22/ton, which translates to roughly RMB 28,000/ton; According to data from the website of Thailand's Ministry of Commerce, the average annual amount of rice exported from Thailand to China is approximately USD 723 million, with an average annual tonnage of about 1.54 million tons. Dividing the average annual amount by the average annual tonnage yields an estimated export price of around USD 467.86/ton for Thai rice. Based on recent average exchange rates, this translates to an export price of about RMB 3,125/ton for Thai rice; According to the statistics from the General Administration of Customs of China, the average annual amount of tapioca exported from Thailand to China is around RMB 1.84 billion, with an average annual tonnage of about 650,000 tons. Dividing the average annual amount by the average annual tonnage yields an estimated export price of around RMB 2,815/ton for Thai tapioca.

Table 5 Values and expressions for the three main variables of the three agricultural products

	Tariff	Demand	Selling price
Durian	0	RANDOM NORMAL (0, 1000, 800, 800, 800)	RANDOM NORMAL (0, 30000, 28000, 28000, 28000)
Rice	IF THEN ELSE (Time <= 365) IF THEN ELSE (Time <= 180, 0.01, 0.65) IF THEN ELSE (Time <= 545, 0.01, 0.8)	RANDOM NORMAL (0,800,600,600,600)	RANDOM NORMAL (0, 5000, 4000, 4000, 4000)
Tapioca	0.13	RANDOM NORMAL (0,400,300,300,300)	RANDOM NORMAL (0, 3000, 2800, 2800, 2800)

CHAPTER IV

VIEW OF AGRICULTURAL TRADE SUPPLY CHAIN

This chapter aims to describe the results obtained from CiteSpace analysis. It summarizes the literature on the ATSC and Sustainable ATSC using bibliometric methods. The results generated by CiteSpace are utilized for country analysis, keyword analysis, author analysis, and reference analysis. The presentation of this section contributes to the achievement of the research objective, which is to provide a view of ATSC.

Countries analysis

1. Study in the ATSC

CiteSpace features country analysis, which primarily showcases the frequency and centrality of article sources. Figure 18 illustrates a world map indicating that a total of 101 countries or territories have contributed papers related to research on the Agricultural Trade Supply Chain (ATSC). The map highlights these areas by painting them blue, with deeper shades representing higher paper contributions from that region. As depicted in Figure 18, the USA and China P.R are the most significant contributors, with 180 and 124 papers, respectively, resulting in the deepest blue areas. Other areas that show comparatively lighter blue shades, indicating their substantial contribution, include Australia, Canada, Brazil, South Africa, and parts of Europe. Blue areas can also be found on all continents, while grey areas represent regions where no papers have been published on the topic.

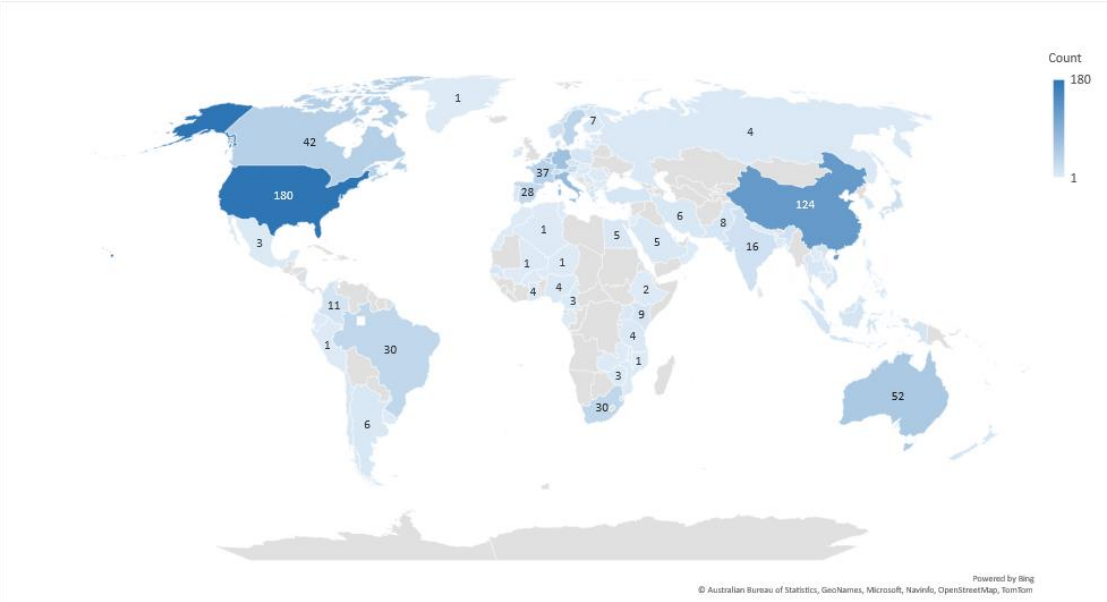


Figure 18 Distribution of research literature on the ATSC per country

In order to provide a clearer picture of the contributions made by major countries, this study excluded 67 countries whose centrality in the Agricultural Trade Supply Chain (ATSC) literature was less than 0.01 and presented the results in Figure 19. It displays nodes representing each country, with the node for the United States being the largest and its outer purple circle also appearing the thickest. Other notable contributors include China P.R, England, Italy, and several other countries with larger nodes. Conversely, smaller nodes such as Slovenia and Latvia are scarcely visible, suggesting that their contribution to the ATSC literature is relatively minor. Moreover, only five nodes appear with outer purple circles: the United States, Australia, England, Netherlands, and France. Notably, while the node for France is smaller than those of China P.R, Italy, Germany, Belgium, and Canada, the latter countries do not have outer purple circles, indicating the continued significance of France's contribution to research on the ATSC.

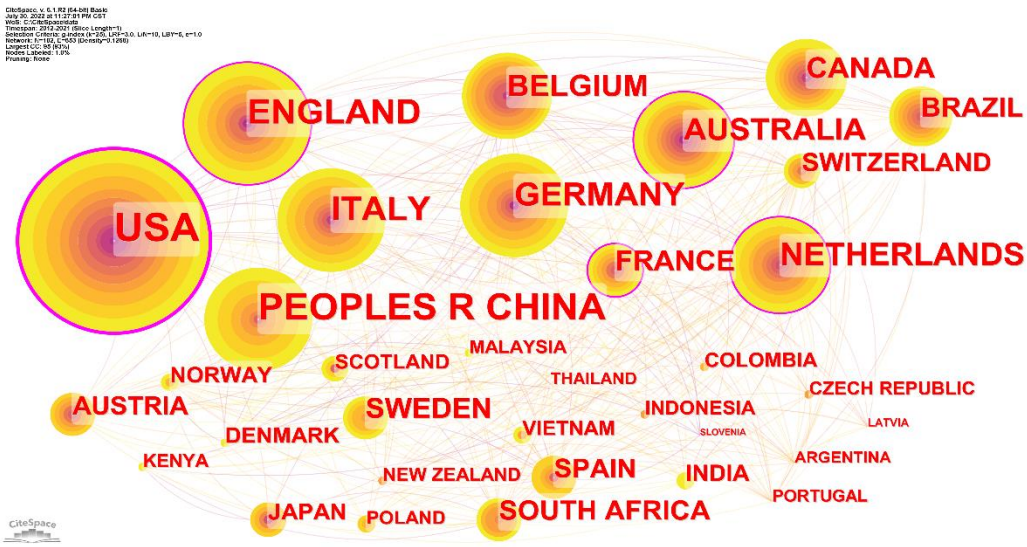


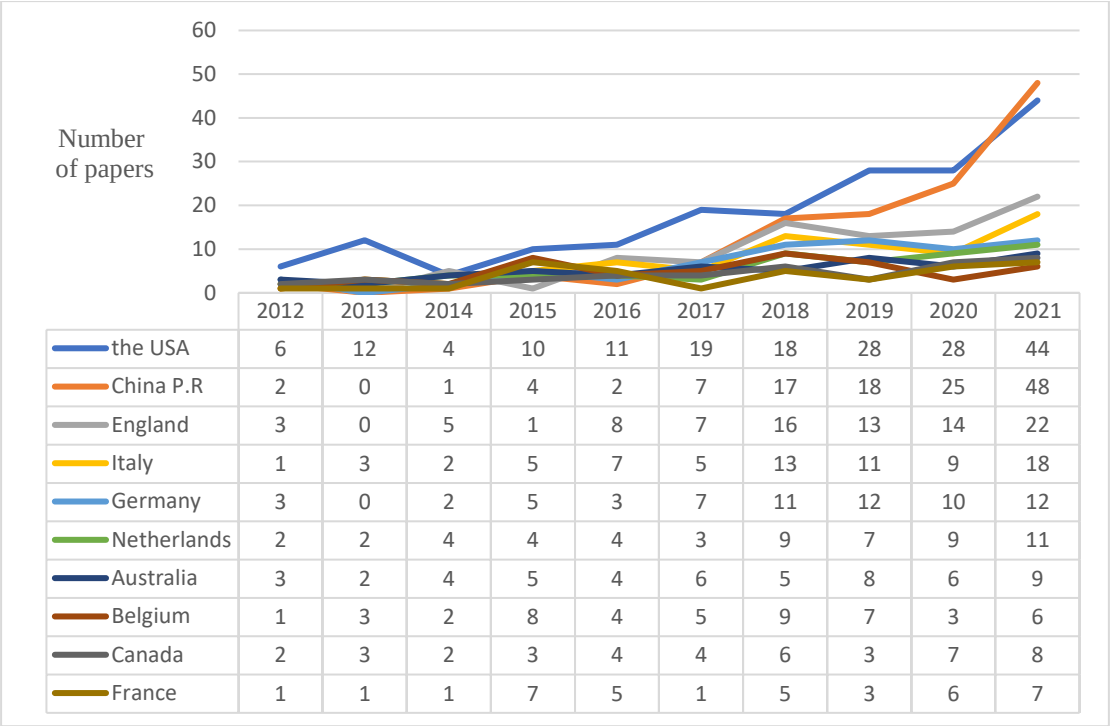
Figure 19 Map of countries or territories

Table 5 reveals that scholars from the United States have made the greatest contribution to research on the Agricultural Trade Supply Chain (ATSC), with a total of 180 papers and the highest centrality score of 0.26. While China P.R has the second-highest paper count, its centrality score is only 0.09, as reflected in Figure 16 by the absence of an outer purple circle around its node. Although England ranks third in terms of paper count, its centrality score is lower than Australia's, which stands at 0.19 despite contributing only 52 papers to the ATSC research field. The Netherlands and France have similar centralities of 0.14, but the former has a higher paper count. A similar pattern can be observed between Italy and Belgium; while the centrality scores for these countries are 0.10, Italy has a larger number of papers. Scholars from other countries or territories, such as Japan and Scotland, make less significant contributions to the ATSC literature in both paper count and centrality compared to the countries mentioned above.

Table 6 List of the ATSC literature published by each country with sort by centrality

Count	Centrality	Year	Countries
180	0.26	2012	USA
52	0.19	2012	AUSTRALIA
89	0.16	2012	ENGLAND
55	0.14	2012	NETHERLANDS
37	0.14	2012	FRANCE
74	0.10	2012	ITALY
48	0.10	2012	BELGIUM
124	0.09	2012	PEOPLES R CHINA
17	0.09	2014	JAPAN
12	0.08	2015	SCOTLAND

It is expected that research on the Agricultural Trade Supply Chain (ATSC) will show varying numbers and centralities of literature contributions due to different development paths. However, in examining the decade spanning from 2012 to 2021, it is worth noting the significant growth of papers from China P.R. As depicted in Figure 20, which displays a line graph of contribution trends, the United States has consistently had the highest number of publications throughout the decade but was overtaken by England and China P.R in 2014 and 2021 respectively. The number of articles published in the USA, China P.R, England, and Italy has also shown an upward trend, suggesting that these countries are increasingly focusing on ATSC research. Notably, the number of papers from China P.R has increased rapidly in recent years, surpassing even the United States with 48 papers in the latest three-year period. Therefore, Chinese research in the field of ATSC should not be overlooked and may become a major force in the future.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
the USA	6	12	4	10	11	19	18	28	28	44
China P.R	2	0	1	4	2	7	17	18	25	48
England	3	0	5	1	8	7	16	13	14	22
Italy	1	3	2	5	7	5	13	11	9	18
Germany	3	0	2	5	3	7	11	12	10	12
Netherlands	2	2	4	4	4	3	9	7	9	11
Australia	3	2	4	5	4	6	5	8	6	9
Belgium	1	3	2	8	4	5	9	7	3	6
Canada	2	3	2	3	4	4	6	3	7	8
France	1	1	1	7	5	1	5	3	6	7

Figure 20 Tend of published papers about the ATSC during 2012 to 2021

Research on the Agricultural Trade Supply Chain (ATSC) is likely to exhibit varying numbers and centralities of literature contributions depending on the development paths of different countries. As evidenced by the figures and table, the United States is undoubtedly the most prominent country in ATSC research, and its studies on the subject are likely to facilitate the development of the field. Given the USA's comprehensive strengths in terms of advanced technology on management and production, as well as extensive land for agriculture, it is a credible leader in the global ATSC landscape. However, it is important to also recognize the growing contributions of China P.R, England, and Italy, which have made significant strides in recent years. China P.R, in particular, is an indispensable country in agricultural consumption and trade and has demonstrated rapid growth in both practical and academic fields. This growth is reflected not only in its increased number of contributions to the ATSC but also in other derivative areas such as live stream selling, which have contributed to China P.R's economic development. Thus, China P.R could become a leading contributor to the ATSC in the future. Future research could focus on case studies of

countries with high literature contributions and centrality, building on the findings summarized in this analysis.

2. Study in the ATSC and Sustainability

Figure 21 presents a map of countries involved in research on agricultural supply chains from the sustainability perspective. The network contains 330 nodes and 349 connections, with a density of 0.0064. The USA has the largest node, indicating its highest frequency of contribution in this field, followed by China, Italy, and England. Each node is surrounded by a purple circle representing the relevance and connection of each country's research. England has the thickest purple circle, followed by Ethiopia and Sweden. Notably, China and Italy have a higher frequency of contribution but fewer collaborations with other countries compared to the other top countries, resulting in fewer connecting lines.

Table 6 displays the top 15 countries ranked by their centrality and frequency in this network, along with their debut year and corresponding centrality and frequency scores. "Centrality" refers to the importance of each country in connecting other nodes. “Frequency” refers to the number of publications. The higher the centrality score, the more critical the country is in maintaining network connections.

The table shows England ranks first in centrality, closely followed by Ethiopia and Sweden. The USA has the most publications with 204, followed by China with 81 and Italy with 66. The debut year of each country is also shown. Since we set the period from 2013 to 2022, any country with a debut year of 2013 likely started publishing earlier.

International cooperation is crucial for sustainable development. We are pleased to see cooperation shaped by England taking form. At the same time, we hope China and Italy can engage in closer cooperation with other countries moving forward.

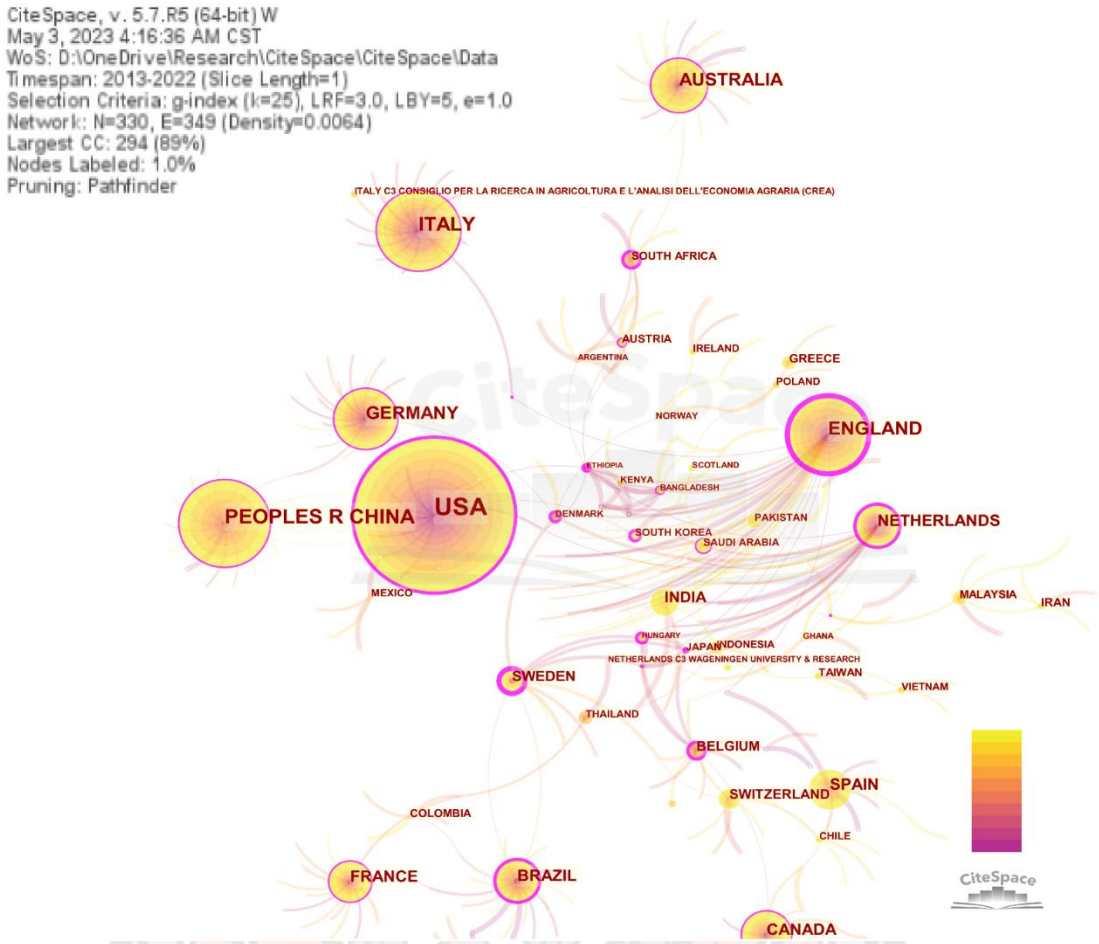


Figure 21 Network of Co-authors' countries

Table 7 List of Top 15 Countries Ranked by Centrality and Frequency

	Centrality	Countries (Year of Debut)	Frequency	Countries (Year of Debut)
1	0.55	ENGLAND (2013)	204	USA (2013)
2	0.47	ETHIOPIA (2013)	81	PEOPLES R CHINA (2013)
3	0.41	SWEDEN (2015)	66	ITALY (2014)
4	0.39	USA (2013)	60	ENGLAND (2013)
5	0.36	NETHERLANDS (2013)	48	GERMANY (2015)
6	0.28	BRAZIL (2013)	41	AUSTRALIA (2014)
7	0.26	HUNGARY (2015)	33	BRAZIL (2013)
8	0.25	BELGIUM (2015)	31	NETHERLANDS (2013)
9	0.23	DENMARK (2017)	29	CANADA (2013)
10	0.23	JAPAN (2015)	29	FRANCE (2015)

	Centrality	Countries (Year of Debut)	Frequency	Countries (Year of Debut)
11	0.23	SOUTH AFRICA (2014)	29	SPAIN (2013)
12	0.20	AUSTRALIA (2014)	27	INDIA (2017)
13	0.20	SOUTH KOREA (2016)	19	SWEDEN (2015)
14	0.18	ITALY (2014)	16	SWITZERLAND (2016)
15	0.18	PEOPLES R CHINA (2013)	15	BELGIUM (2015)

Keywords analysis

1. Study in the ATSC

In order to gain a better understanding of the research area of Agricultural Trade Supply Chain (ATSC), it is important to analyze its keyword trends. This can be achieved through techniques such as citation burst analysis, keywords cluster analysis, and keywords frequency and centrality analysis. The top 10 most frequently used keywords in ATSC are "supply chain," "impact," "trade," "management," "consumption," "international trade," "model," "system," "life cycle assessment," and "food."

Table 7 presents the top 10 keywords of the ATSC and sorts by count and centrality separately. The most frequent occurrence is “supply chain”, which has been counted as 114. The followed keywords are "impact” (78), “trade” (64), “management” (63), “consumption” (51), “international trade” (45), “model” (42), “system” (40), “life cycle assessment” (36), and “food” (32). Besides, another index in Table 7 is also significantly valued to refer, that is, centrality.

The keywords of “food” show the highest centrality with 0.17, which means “food” largely impacts research area of the ATSC and undertakes a hinge for other keywords. The keyword “management” is calculated as 0.13 and takes the second most centrality, and the followed is “supply chain” with 0.11 of centrality. The fourth highest index of centrality is 0.09, which included by “impact” and “life cycle assessment”. The rest of top 10 high centrality keywords are “trade”, “system”, “environmental impact”, “governance”, and “agriculture” with 0.07 index of centrality. In addition, we noticed that the keywords “supply chain” (count=114, centrality=0.17), “impact” (count=78, centrality=0.09), “trade” (count=64, centrality=0.07), “management” (count=63, centrality=0.13), “system” (count=40, centrality=0.07), “life cycle assessment” (count=36, centrality=0.09) , and “food” (count=32, centrality=0.17) show

on the both lists of the frequency and the centrality. The keywords “supply chain” and “trade” are words in the topic “Agricultural trade supply chain”, therefore, we focus on the rest of keywords.

The keyword “impact” generally shows an interaction between the relevant ATSC knowledge and the other in this analysis, such as influence between agricultural production and environment. Research on the other keywords also appear plenty of the keyword "impact", therefore we will interpret other keywords without repeating the literature on "impact".

Management, act of method to achieve purpose, most of study in supply chain is related to management. In fact, researchers explore supply chains to manage for achievement, such as sustainability and stability. For instance, supply chain with farmers, biomass traders, transporters, and end users will be regularized by traceability system for product quality (Bosona et al., 2018; Lafargue et al., 2021). Supply chain itself represent a network of organizations (Christopher, 1999), which is constituted by the object of the management philosophy, the target group, the objective(s) and the broad means for achieving these objectives (Stadtler, 2008). The majority supply chain scholars research about management, such as risk management for mitigating supply chain disruptions (Nooraie & Parast, 2016), integrating invasive species management for ornamental horticulture supply chains to prevent plant invasions (Hulme et al., 2018), management of innovative collaboration to reduce post-harvest food losses for the Colombian and Mexican avocado supply chain (Bustos & Moors, 2018). As a result of that, research in the ATSC which work for management will be more important with centrality.

System, a group of connected things or devices that run together, generally is relevant to framework and structure (Ren, 2017). Scholars integrate knowledge from system and supply chain management and present framework and assessment approach, such as resilience of agricultural value chains in developing country (Vroegindewey & Hodbod, 2018). However, there is not only factor of supply chain in the ATSC, also agriculture and trade are. The production process in agriculture has been studied for years, ecosystem on agricultural trade is seriously concerned (Mattias et al., 2021). Before researchers can be interested in the ATSC, they should have some knowledge about system design or construction.

Agricultural product we defined above consist of food and fuel, and the former is more significant with the highest centrality index. Due to food as main thing that directly digested by human, its problems are inevitably concerned, such as safety (Baines et al., 2017), policy (Hawkes et al., 2012), sustainability (Rich et al., 2018), protective effect of financial inclusion (Fang, & Zhang, 2021). In addition, researchers mainly consider specific agricultural products like peanuts (Kamika et al., 2014), beef (Cao et al., 2021), yoghurt (Le Port et al., 2017) etc. In research of the ATSC, agricultural product should be focus on food.

Life cycle assessment is an evaluation technique used over the life cycle of a product or product-related aspect (Muralikrishna & Manickam, 2017), which acts an important environmental management tool since 1960s. As defined by ISO14040, life cycle assessment is a method used to assess the environmental factors and potential impacts associated with a product (or service), which is carried out by compiling a stock record of the inputs and outputs associated with a system, assessing the potential environmental impacts associated with these inputs and outputs, and interpreting the stock records and the results of the analysis of the environmental impact according to the objectives of the life cycle assessment study. Research in the ATSC, life cycle assessment has been used on sustainable development goals (Vanham et al., 2019), bioethanol green supply chain (Miret et al., 2016), synthesis matrix system for food security (Karabulut et al., 2018).

Table 8 Top 10 keywords of the ATSC by sorting frequency and centrality

Count	Keywords (Rank by frequency)	Centrality	Keywords (Rank by centrality)
114	supply chain	0.17	food
78	impact	0.13	management
64	trade	0.11	supply chain
63	management	0.09	impact
51	consumption	0.09	life cycle assessment
45	international trade	0.07	trade
42	model	0.07	system

Count	Keywords (Rank by frequency)	Centrality	Keywords (Rank by centrality)
40	system	0.07	environmental impact
36	life cycle assessment	0.07	governance
32	food	0.07	agriculture

CiteSpace provides calculation of citation bursts in keywords analysis. After setting model in control panel, 13 keywords have been arranged in Figure 22. The strongest citation bursts mean a large change in the number of citations over a certain period within 2012-2021. It is used to discover the decline or rise of subject words or keywords (Chen, 2014). The lines under the “2012-2021” represent timeline of the matching keywords on the left side. For instance, the keyword “3rd party certification” offers strong citation between 2013 and 2015. Due to the time slicing we set that between 2012 and 2021 in CiteSpace, each beginning or ending year should be viewed more extendable than it shows. Therefore, ending years of the keywords “land use change”, “design”, and “forest” should be considered as period ending after 2021. Moreover, the keywords above are particularly noteworthy because they have appeared as the keywords with strongest citation bursts in recent years, which can be the key to future research in the ATSC.

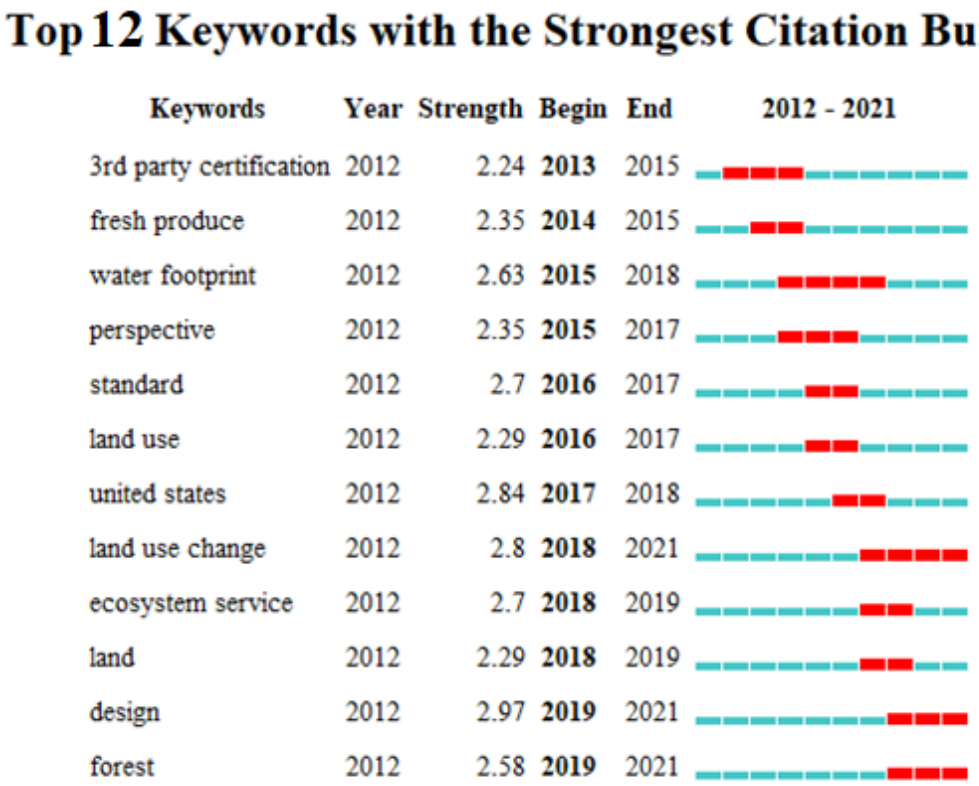


Figure 22 Top 12 keywords with the strongest citation bursts in the ATSC

In addition to the commonly used keywords of "trade" and "supply chain," there are several other noteworthy keywords that indicate hotspots in the Agricultural Trade Supply Chain (ATSC) research area. These keywords often relate to environmental issues, particularly factors such as land and water, which have been mentioned frequently in this field.

Furthermore, there are certain keywords that exhibit the strongest citation bursts, indicating the development process of ATSC. These keywords suggest that topics such as "land use change," "design," and "forest" may require careful attention in future research endeavors. It is essential to closely monitor these areas of interest to ensure the sustainability and effectiveness of ATSC practices.

2. Study in the ATSC and Sustainability

Keywords concisely describe document contents and serve as an important means of understanding a research area (Chen, 2013). Figure 23 presents a network of co-occurring keywords, containing 384 nodes and 648 connecting lines with a density of 0.0088. This indicates the keywords have some degree of association. Analyzing keywords helps identify the scope and features of a research field, clarifying its academic development. Through keyword analysis, we can examine the distribution of words to scout the landscape.

To highlight the most influential and crucial words in this field from 2013-2022, we will generate keywords with the strongest citation bursts, showcasing research hotspots and frontiers over the past decade.

Each keyword is marked with a cross-shaped node and connected by lines. More lines indicate higher centrality of that point. Larger nodes signify higher keyword frequency. As shown, sustainability, agriculture, supply chain, management, system, impact appear more frequently, with significantly larger nodes. Although centrality is difficult to discern from the figure, we see larger nodes do not necessarily have more lines. Higher frequency does not represent higher centrality. For instance, food, impact, system, and agriculture do not have many connections compared to other keywords.

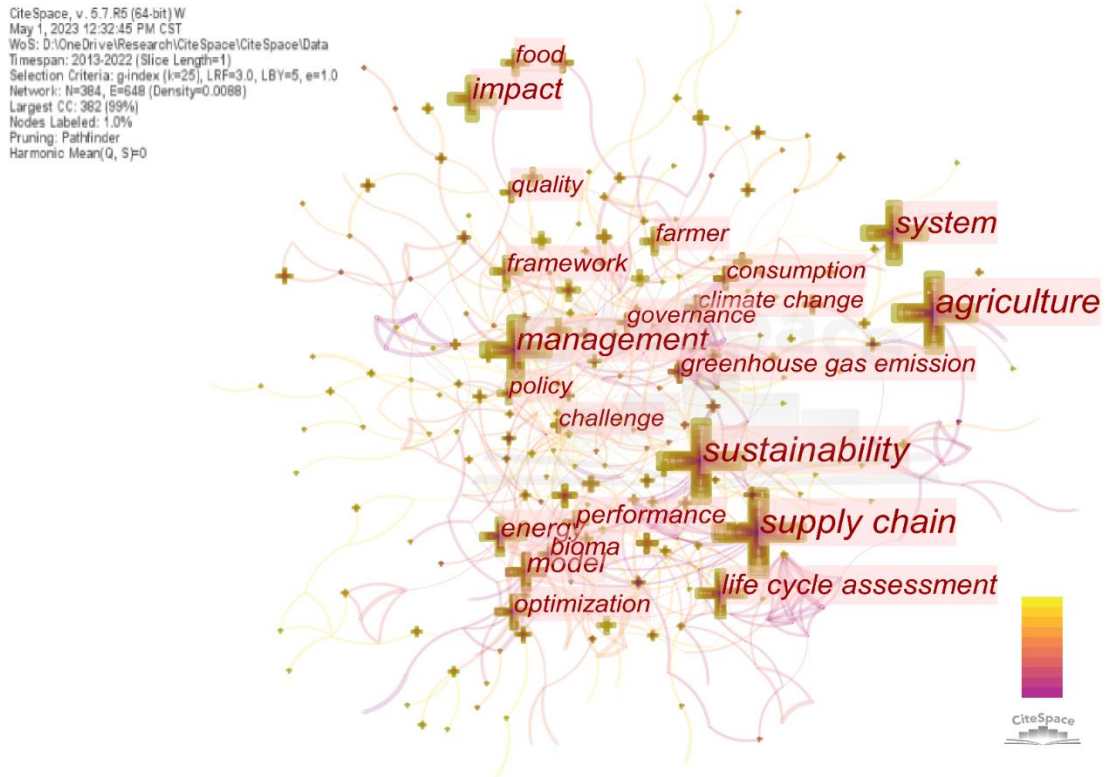


Figure 23 Network of keywords co-occurring

Table 8 displays the top 10 keywords by centrality and frequency, generated through co-occurring author keywords in CiteSpace. The centrality keywords and debut years are greenhouse gas emission (2013), model (2013), sustainable development (2018), initiative (2017), environmental impact (2014), supply chain (2013), challenge (2017), carbon (2018), corporate social responsibility (2013), and consumption (2013). The frequency keywords and debut years are sustainability (2013), agriculture (2013), supply chain (2013), management (2014), system (2014), impact (2016), life cycle assessment (2014), model (2013), energy (2014), and performance (2016). In the context of agricultural supply chains, these keywords represent important view driving sustainability efforts.

"Centrality" refers to a keyword's influence and importance in the network of scientific papers on ASC from the agricultural sustainability perspective. High centrality indicates prevalence and significance in this literature. These keywords reflect key concerns and challenges, like ecological impacts and the need for ethical

long-term planning.

"Frequency" refers to how often a keyword appears in article titles/abstracts over a period. In ASC and agricultural sustainability research, higher frequency suggests greater attention and importance researchers have placed on that concept recently. For instance, the high frequency of "sustainability," "agriculture," and "supply chain" implies these concepts have received significant focus, potentially indicating growing recognition of sustainable agriculture and supply chain management in addressing food system challenges. Comparatively lower frequencies like "energy" and "performance" suggest they are important but less extensively studied in this context.

Table 9 List of Top 10 keywords of centrality and frequency

	Centrality	Keywords (Year of Debut)	Frequency	Keywords (Year of Debut)
1	0.23	greenhouse gas emission (2013)	197	sustainability (2013)
2	0.21	model (2013)	189	agriculture (2013)
3	0.20	sustainable development (2018)	180	supply chain (2013)
4	0.20	initiative (2017)	127	management (2014)
5	0.18	environmental impact (2014)	107	system (2014)
6	0.17	supply chain (2013)	81	impact (2016)
7	0.17	challenge (2017)	70	life cycle assessment (2014)
8	0.14	carbon (2018)	65	model (2013)
9	0.14	corporate social responsibility (2013)	54	energy (2014)
10	0.13	consumption (2013)	46	performance (2016)

Table 9 presents the top 20 keywords related to agricultural sustainability from 2013-2023, along with strength scores and begin/end years. This provides a list of relevant keywords reflecting key concerns and challenges.

Initial keywords like greenhouse gas emissions (2013-2015) and nitrous oxide emissions (2014-2015) highlight agriculture's environmental impact and reducing emissions. Biofuels (2014-2017), bioenergy (2014-2019), ethanol (2014-2018), and palm oil (2015-2019) reflect balancing energy versus sustainable land use and avoiding ecological damage like deforestation. Cattle (2015-2018) and food waste

(2016-2018) address waste reduction and ethical animal treatment. Short food supply chains (2020-2022) explore reducing food miles and local sourcing for sustainability. LCA (2017-2018), carbon footprint (2017-2019), standard (2018-2020), and certification (2019-2020) relate to measuring and verifying practices. Knowledge (2019-2020) indicates research/education needs, while waste (2020-2022) focuses on waste reduction and circularity.

Generally, early research concentrated on emissions, particularly regarding biomaterials, biofuels, and bioenergy. Subsequent efforts examined biological practices like cattle and palm oil. Next, research emphasized practices involving carbon footprint, standards, knowledge, and certification. More recently, short supply chains and waste research signal growing interest. Brazil and USA's presence as keyword countries suggest notable contributions - Brazil potentially advancing biological practices, and the US driving LCA, carbon footprint, and standards.

These keywords reflect the complex challenges and opportunities in creating a sustainable ASC. By incorporating these concepts, researchers and practitioners can identify areas to intervene and innovate.

Table 10 Top 20 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2013 - 2022
Greenhouse gas emission	2013	3.56	2013	2015	
bioma	2013	2.85	2013	2015	
biofuel	2013	5.96	2014	2017	
scale	2013	3.04	2014	2017	
ethanol	2013	2.90	2014	2018	
nitrous oxide emission	2013	2.47	2014	2015	
bioenergy	2013	2.44	2014	2019	
cattle	2013	3.13	2015	2018	
brazil	2013	2.92	2015	2016	

Keywords	Year	Strength	Begin	End	2013 - 2022
palm oil	2013	2.85	2015	2019	
fuel	2013	2.68	2015	2018	
food waste	2013	2.57	2016	2018	
lca	2013	3.41	2017	2018	
carbon footprint	2013	2.81	2017	2019	
united states	2013	2.66	2017	2018	
standard	2013	2.47	2018	2020	
knowledge	2013	3.54	2019	2020	
certification	2013	2.42	2019	2020	
short food supply chain	2013	3.08	2020	2022	
waste	2013	2.54	2020	2022	

Author analysis

1. Study in the ATSC

CiteSpace shows all the authors whose papers have been cited and calculates the count and centrality. To better present author information, we extracted the top 10 authors who have the most citation and centrality on Table 10. Food and Agriculture Organization of the United Nations (FAO) has been cited most with 234 times, and followed cited authors are Lenzen M (count=64), World Bank (count=55), European Commission (count=41), Wiedmann T (count=35), Reardon T (count=34), Kastner T (count=32), Peters GP (count=28), Hoekstra AY (count=28), and Yu Y (count=24). For the centrality, the U.S Department of Agriculture (USDA) brings the highest score which is 0.26. The FAO takes the second most score with 0.23, followed cited authors are Godfray HCJ and Altieri MA with 0.20. The centrality of the rest of cited authors are Defries RS (centrality=0.19), Clapp J (centrality=0.18), Chen B (centrality=0.17), Choi Y (centrality=0.16), Lenzen M (centrality=0.14), and Meyfroidt P (centrality=0.14). We noticed some organizations are in this list, which are the FAO, World Bank, European Commission, and the USDA. We think it is because many authors need to cite data from these organizations when conducting research, which is

why they are highly cited and central. For instance, in node detail of the FAO, research with high citation mentions growing data of agricultural trade in trading forests (Henders et al., 2015), and another highly cited paper presents data about global land use for research about tele-connecting local consumption (Yu et al., 2013). Despite the enormous influence of international organizations, we cannot ignore the contributions of individual authors. Scholars generally agree that biodiversity has been threatened by international trade in developing countries (Lenzen et al., 2012) and contribute knowledge in combination with agriculture and supply chain. With contribution from Lenzen M, scholars propose orientations of the ATSC, such as biomass use, land conservation, land use, sharing responsibility and resource (Weinzettel et al., 2019).

Table 11 Top 10 Cited authors of the ATSC

Count	Author (Rank by frequency)	Centrality	Author (Rank by centrality)
119	FAO	0.26	USDA
64	LENZEN M	0.23	FAO
55	WORLD BANK	0.20	GODFRAY HCJ
41	EUROPEANCOMMISSION	0.20	ALTIERI MA
35	WIEDMANN T	0.19	DEFRIES RS
34	REARDON T	0.18	CLAPP J
32	KASTNER T	0.17	CHEN B
28	PETERS GP	0.16	CHOI Y
28	HOEKSTRA AY	0.14	LENZEN M
24	YU Y	0.14	MEYFROIDT P

International organizations such as the Food and Agriculture Organization (FAO) and World Bank are valuable sources of literature and data for researchers in the Agricultural Trade Supply Chain (ATSC) field. Their insights and advice are integral to many research projects in this area.

Moreover, the research direction of ATSC is closely linked to international trade and biodiversity, which was initially explored by Lenzen M. This foundational work has guided subsequent research efforts in the field and highlights the importance

of understanding the broader context within which ATSC operates.

2. Study in the ATSC and Sustainability

Figure 24 shows the co-authorship network for ASC researchers from the agricultural sustainability perspective. The network has a density of 0.0046 with 315 nodes and 227 connecting lines. As shown, there are few connections between dots, indicating limited collaboration among authors in this field.

Chianan Wang from National Kaohsiung University of Science and Technology has the largest node with 5 total articles, but the network shows minimal connections between him and other scholars. Evagelos D. Lioutas and Chrysanthi Charatsari from Greece have the next largest nodes with 4 articles each.

Nevertheless, some collaborative efforts are visible. Ilona E. de Hooge, Jessica Aschemann-Witzel, and Harald Rohm have the largest collaboration focused on food waste research, with mutual connections. Waste management research centered on Shristi Kharola and Sachin Kumar Mangla also shows scholarly connections.

Overall, the low density indicates most academics have minimal collaboration. The network shows few author connections, with only a few collaborating on certain topics. There also appears to be limited cooperation across topics among authors. More collaboration would likely benefit the field.

Figure 24 Network of co-author

Reference analysis

1. Study in the ATSC

Reference analysis is the most characteristic function in this study. CiteSpace illustrates 467 nodes and 955 lines which represents relationships of the clusters in Figure 25. Each shadow represents a cluster which are totally 13 clusters sort by #0 to #13 without #10. Network structure of the modularity Q in this map is significant with 0.8885, and weighted mean silhouette is 0.9274 which represents high similarity of cluster due to the number close to 1 (Zeng et al., 2021). The clusters obtained are “effective zero-deforestation commitment”, “south asia”, “quantifying global ch4”, “measuring telecoupling”, “global supply chain”, “global agricultural trade”, “environmental footprint family”, “sustainable landscape design”, “carbon emission”, “innovative blockchain-based farming marketplace”, “virtual water trade”, “regional organic food supply”, and “driver”. The first five clusters, which obtain big size of shade in Figure 19, are analyzed with representative literatures.

Figure 25 Map of reference analysis with clusters

The cluster of “effective zero-deforestation commitment” is divided by 10 articles with 0.898 of silhouette value and the average paper published year is 2018, which represent research area of this cluster has been concerned within about 3 years. The Zero Deforestation Commitment is being made to against day-to-day environmental degradation, such as climate change. In fact, many institutions or countries around the world are delivering on their commitments, such as the United Nations Sustainable Development Goals and the Paris Agreement. While existing commitments are in line with expectations for zero deforestation, the terms in the commitments still fail to cover most of the global market for deforestation-risk commodities (Garrett et al., 2019). For sustainable development of production ecosystems, agricultural sector requires realignment of finance and greater transparency and traceability of supply chains (Nyström et al., 2019). Briefly, scholars have realized that papers about the ATSC assist to improve effective zero-deforestation commitment.

The cluster of “south Asia” is including 9 articles with 0.93 of silhouette value and the mean year of paper published is 2020, which signify research area of this cluster has been proposed recently. South Asia geographically encompasses India, Bangladesh, Bhutan, Maldives, Nepal, Pakistan, Sri Lanka, Afghanistan. The region remains home to the poor in many developing countries (World, 2014). With the Covid19 discovered at the end of 2019, humanity is facing damaging challenges in survival. Compared with the more mature food supply chains in other regions, the food supply chains of South Asian countries deserve more attention from scholars. The case studies in the region of South Asia have given valuable references in food supply chains (Vyas et al., 2021), value chains (Van Hoyweghen et al., 2021), sustainable agriculture (Rasul, 2021), blockchain technology (W et al., 2020), food systems (Fan et al., 2021).

The cluster of “quantifying global ch4” collected 8 articles with 0.857 of silhouette value and the mean year is 2018. CH4 is the simplest form of alkane and consists of one carbon atom and four hydrogen atoms, which is the simplest hydrocarbon and the main component of natural gas. Reducing CH4 emissions from paddy is of great significance to alleviate global warming. Although agricultural CH4 emissions from developed countries have decreased significantly over the past decade, some scholars have found that the reduced agricultural CH4 emissions are likely to have

shifted from developed to developing countries, and most of CH4 emissions are related to international trade (Tian et al., 2019). Paddy, as source of the ATSC, is serious CH4 emission in the atmosphere, and should be discussed with quantifying global CH4 emission (Wu et al., 2018). Therefore, research of the ATSC is indispensable to research in global CH4 emission issue and quantifying is for precise management of the issue.

The cluster of "measure telecoupling" is included 8 articles with 0.946 of silhouette value and the average year of paper published is 2015, which is an antiquated research area to other clusters. Previous studies in telecoupling focused on teleconnections of climate system (Wallace & Gutzler, 1981) and globalization of human systems (Liu et al., 2019). Study of telecoupling in these days is about that interrelatedness of changes in certain area impacts other area. And scholars in this cluster refer to account and calculate footprint (Bruckner et al., 2015) and land use (Chen & Han, 2015). Articles about measure telecoupling enriches research in the ATSC and makes us realize that collaboration between different systems is essential.

The cluster of "global supply chain" is divided by 10 articles with 0.86 of silhouette value and the mean year is 2019. Global Supply Chain combines supply chain with globalization. Similar with other study of supply chains, global supply chains study risk (Manuj & Mentzer, 2008) and design (Meixell & Gargeya, 2005). However, global supply chains face more difficult challenges. Because the nodes involved in the global supply chain may be in many different regions, and environment issues (ecosystem, policy, economics, etc.) between regions is different, it is difficult to manage global supply chain like other supply chains. In this cluster, global supply chain is referred by case studies in various area and diver aspect such as study for re-framing post-harvest losses with pineapple value chain in Uganda (Tröger et al., 2020), study for global land use of diets in Palau (Nakamura et al., 2021), and rethinking about energy issues with impact of Sino-US trade imbalance (Li et al., 2020). Moreover, environmental issues relevant with food waste (Bajželj et al., 2020) and emission (Uwizeye et al., 2020).

Over the past decade, there has been a significant focus on researching environmental issues with a perspective of sustainable development. Scholars have shown concern for managing the agricultural, forestry, and fisheries sectors in the production, trade, and consumption processes to address deforestation and emissions.

As economic globalization continues to progress, researchers have realized that no economy can ignore environmental issues. Therefore, studying environmental issues from the lens of the agriculture, forestry, and fisheries sectors is imperative for the sustainable development of human activities.

2. Study in the ATSC and Sustainability

Compared to traditional co-citation analysis, CiteSpace offers additional insights by incorporating indicators and subject tags from cited literature. It also includes year-to-year concept tags to track cluster evolution, along with hierarchical representations of conceptual terms extracted from titles and abstracts. This enables a more comprehensive and nuanced analysis of the literature than co-citation alone.

Specifically, CiteSpace highlights important connections and trends that traditional co-citation may miss. By tagging citations, tracking conceptual changes over time, and extracting key terms, CiteSpace provides extra context about the meaning and relationships between citations. This additional information paints a richer picture of how ideas have developed in each field. As a result, CiteSpace facilitates more detailed examination of the literature that goes beyond just identifying influential publications through co-citation counts. The added capabilities make it a valuable complement to conventional co-citation techniques for analyzing scholarly progress and significance (Chen, & Song, 2019).

Document co-citation analysis is a technique that involves selecting a representative sample of literature as the objects of analysis. These documents are then analyzed using network analysis to divide them into clusters. This clustering reveals the underlying structure and evolutionary trajectory of a particular research domain. Specifically, when two documents are frequently cited together in subsequent publications, they are considered "co-cited." By mapping these co-citation connections, clusters of related documents emerge. The composition and formation of these clusters' sheds light on the relationships between influential publications and how ideas have developed over time. Examining the evolution of clusters across periods can trace the progression of a field (Liao et al., 2018). CiteSpace utilizes a series of algorithms to determine clustering properties and terminology based on frequency, inverse document frequency, and log-likelihood ratios (LLR) (Dunning, 1994). Using CiteSpace with a node type of "Reference," we analyzed 756 studies to generate a list of the most central

and frequently cited literature. The resulting document co-citation network shown in Figure 26 displays the centrality of each article through font size, while node size represents citation frequency, as detailed in Table 11. Articles with high centrality (above 0.1) indicate intersections of research across disciplines related to the sustainability of agricultural trade supply chains.

Table 12 Top 10 Document co-citation ranked by centrality and cited frequency

	Centrality	Cited Reference (Rank by centrality)	Frequency	Cited Reference (Rank by frequency)
1	0.49	Garrone P (2014)	24	Kamble SS (2020)
2	0.48	Garnett T (2013)	19	Kamilaris A (2019)
3	0.47	Brautigam KR (2014)	17	Notarnicola B (2017)
4	0.47	Popp J (2013)	16	Galvez JF (2018)
5	0.47	Badia-Melis R (2015)	16	Lezoche M (2020)
6	0.29	Rueda X (2017)	15	Saberi S (2019)
7	0.29	Govindan K (2018)	15	Poore J (2018)
8	0.25	Gobel C (2015)	15	Willett W (2019)
9	0.21	Balaji M (2016)	12	Sharma R (2020)
10	0.17	Godfray HCJ (2010)	12	Wolfert S (2017)

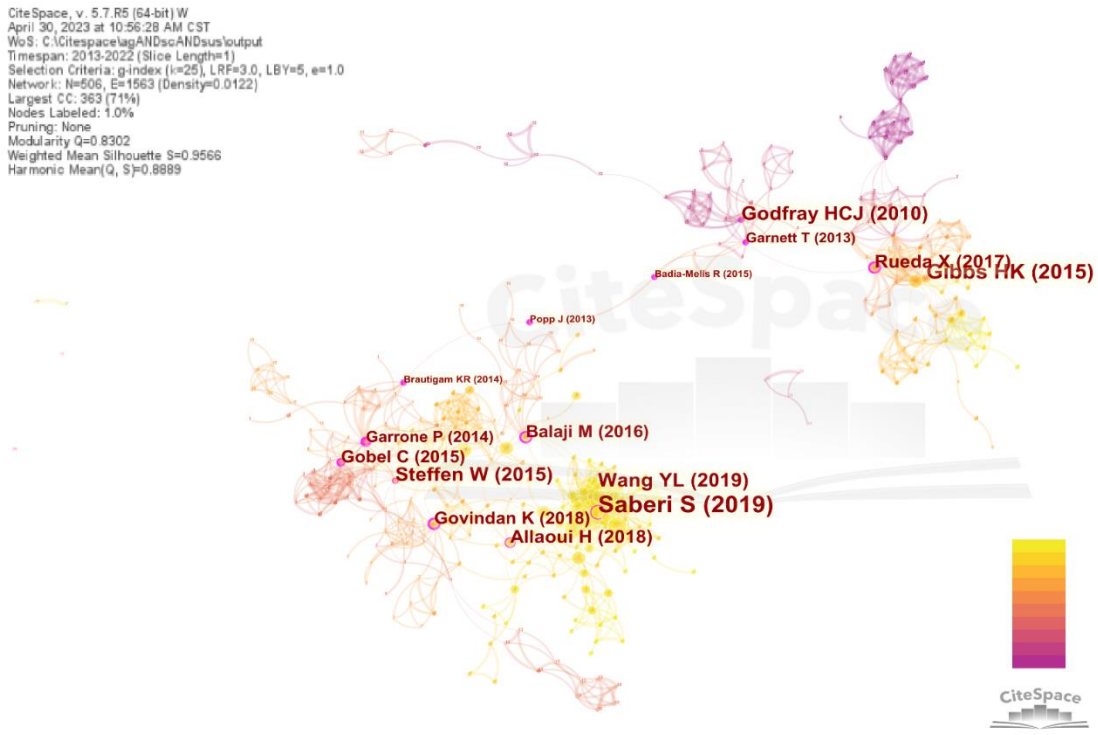


Figure 26 Document co-citation map

Figure 27 visualizes the sustainability of the agricultural trade supply chain using a cluster map based on "title," with a modularity Q value of 0.8302. This high value indicates a qualified map, comprised of 506 nodes and 1563 links. The map contains 14 research clusters on agricultural trade supply chain sustainability, grouped into distinct topics listed in Table 12. Silhouette values from 0.894 to 1.000 suggest highly related research within each cluster. Furthermore, the research topics extracted by the LLR and MI algorithms reveal both independent characteristics and interconnections across clusters. The 5 largest clusters are described in detail below, highlighting their key research areas.

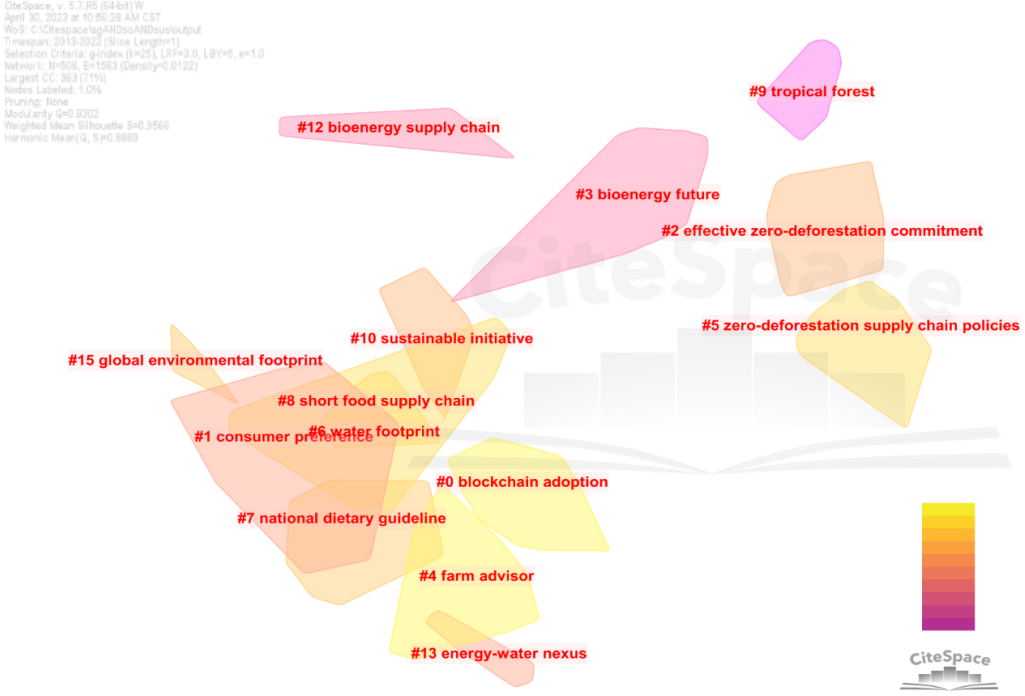


Figure 27 Cluster Map of Sustainability of Agriculture Trade Supply Chain

Table 13 Fourteen Clusters of Sustainability of Agriculture Trade Supply Chain

Cluster	Size	Silhouette	Year	LLR
0	62	0.935	2019	blockchain adoption
1	42	0.894	2014	consumer preference
2	38	0.969	2015	effective zero-deforestation commitment
3	32	0.963	2012	bioenergy future
4	28	0.990	2018	farm advisor
5	28	0.944	2017	zero-deforestation supply chain policies
6	24	0.952	2016	water footprint
7	23	0.944	2016	national dietary guideline
8	22	0.984	2017	short food supply chain
9	19	0.989	2010	tropical forest
10	16	0.994	2015	sustainable initiative
12	11	1.000	2012	bioenergy supply chain
13	10	1.000	2013	energy-water nexus
15	8	1.000	2017	global environmental footprint

Substantial food losses occur throughout the food supply chain owing to inadequate technical infrastructure and various organizational challenges (Food and Agriculture Organization, FAO). While blockchain technology (BT) is viewed as a disruptive innovation that can enable sustainable supply chain performance, its effectiveness in improving agricultural sustainability has been limited thus far (Ali et al., 2021). This phenomenon may be due to the limited transparency around sustainability practices, the lack of supply chain stakeholder collaboration, unequal data access and control, weak commitment to sustainability goals, and insufficient cooperation between companies and government on sustainability efforts (Zkik et al., 2022). Therefore, scholars are making efforts to address these issues. The success of sustainable supply chains in agriculture depends not only on technological innovations like blockchain-based platforms, but also on broader policy, regulatory, and social factors. For example, while Leduc et al. (2021) proposed a blockchain-based farming marketplace to improve food tracking and traceability, the effectiveness of such platforms also relies on appropriate government policies and regulations around food safety and transparency (Ali et al., 2021). Furthermore, integrating blockchain into existing supply chain systems in a way that enables greater data sharing and transparency could promote social cooperation among supply chain stakeholders (Mangla et al., 2021). Overall, realizing the potential of blockchain to support agricultural sustainability requires holistic thinking that considers technology, policy, regulatory, and social dimensions together. Simply developing blockchain platforms is not enough without also addressing the wider organizational, institutional, and behavioral contexts in which they would operate.

The theory of planned behavior suggests that a consumer's intent to carry out a behavior is influenced by their perceived control over the behavior, their attitude toward the behavior, and subjective norms related to the behavior (Ajzen, 1985). Subjective norms refer to a consumer's perception of whether significant others approve or disapprove of the behavior. Research shows that consumers waste a significant portion of food - up to one third of total food waste happens at the consumer level (Bräutigam et al., 2014; Buzby & Hyman, 2012). However, the amount of food wasted in households continues to rise despite efforts to reduce waste across supply chains (Kretschmer et al., 2013). Therefore, understanding consumer preferences in food

selection is critical to help supply chains and policy makers reduce food waste and improve resource efficiency. Studies have found that discounts strongly influence consumers' willingness to purchase suboptimal foods like products that are close to expiration or have damaged packaging. When the discount makes the product worthwhile, consumers are open to buying foods that are less than perfect (de Hooge et al., 2017). Strategies to promote suboptimal foods to consumers can help reduce waste (Rohm et al., 2017). Overall, reducing household food waste requires cooperation across the supply chain and interventions aimed at consumer education, incentives, and changing food environments (Aschemann-Witzel et al., 2017).

Zero-deforestation commitments (ZDCs) are pledges made by companies to eliminate deforestation from their supply chains and promote sustainable forestry. Though well-intentioned, ZDCs have limitations in their effectiveness. An assessment of 52 corporate ZDCs found shortcomings in the extent of market coverage, lack of real-time monitoring, and delayed implementation deadlines (Garrett et al., 2019). For ZDCs to be impactful, they need to become embedded in corporate strategy with enforcement mechanisms. A case study in Brazil showed how governance policies and projects of the Sustainable Agriculture Network enabled expansion of cattle sustainability programs and reduced deforestation (Alves-Pinto et al., 2015). The success of such governance depends on available environmental resources, market access, knowledge sharing, stakeholder involvement, and network strength. These factors significantly influence whether governance mechanisms fail or succeed (Hajjar et al., 2019). In summary, while ZDCs show promise, their limitations need addressing through strategic integration, sanction-based enforcement, multi-stakeholder governance, and leveraging key enabling factors.

Biomass resources like agricultural crops, forest products, residues, manures, and wastes can be utilized for bioenergy production. Agriculture biomass and forestry biomass are two main sources of biomass feedstocks (Hoogwijk et al., 2003). Promoting bioenergy in the agricultural sector can make it more sustainable and help achieve climate change goals. However, implementing bioenergy projects requires considering trade-offs with food security, biodiversity, and land use. A country with strong bioenergy ambitions, like the UK which has binding renewable energy and emissions targets, may explore bioenergy from multiple perspectives - food-focused,

economically-focused, conservation-focused, and energy-focused (Welfle et al., 2014).

The approach to farm advisory work has evolved significantly from the focus on authoritative guidance to the adoption of more diverse advisory systems (Nettle et al., 2017). Nowadays, Agriculture 4.0 already existed, and the characteristics are closely related to technology, such as the internet of things (IoT), big data, blockchain, artificial intelligence (AI), etc. Such technologies integrated the farming system into cyber-physical-social systems (Lioutas et al., 2019). On the one hand, the major outcomes related to sustainable agriculture supply chains, circular economy, integrated enabling technologies, and supply chain performance indicate that the Internet of Things and information communication technology have a significant impact on addressing food security, traceability, and food quality (Nayal et al., 2021). From the perspective of organization's managers, the application of new technology into the agriculture supply chain will increase the resilience of the supply chain, especially during Covid-19 (Yadav et al., 2021). On the other hand, it is not clear whether the use of these technologies is good or bad for the sustainable development of agriculture. A responsible research framework was proposed to focus on these issues and the result shown that for the sustainability of the agriculture supply chain, the use of digital technologies, which are linked to the process of land capitalization, is leading to increasing inequalities in terms of land access and farmer independence and the use of these technologies cannot be considered responsible innovation at present (Duncan et al., 2022). Therefore, new responsibilities of farm advisors are created. Charatsari et al. (2022) illustrated that the shift towards Agriculture 4.0 necessitates the development of a novel mindset, where information and technology are deemed more trustworthy than human counsel and leads to new responsibility gaps. Meanwhile, from the consideration of farm advisors, they see agriculture 4.0 as a disruption rather than a promise. In addition, Jackson and Cook (2022) highlight the notion of the "technology fallacy", which suggests that digital transformation is not solely about the technology, but also involves organizations, individuals, learning, and processes. Although digital technologies facilitate change, the pace of transformation ultimately depends on the people involved.

View of agricultural trade supply chain

The view of Agricultural Trade Supply Chain (ATSC) views agricultural trade from a supply chain perspective, emphasizing the process of agricultural trade. It can include the production, storage, transportation, trading, marketing and consumption of agricultural products.

Researchers from the United States and the United Kingdom have played important roles in ATSC research. Meanwhile, contributions from researchers in European countries like France, Germany, and the Netherlands as well as Australia are also noteworthy. It is worth noticing that Chinese researchers' contributions in this field have been rapidly increasing.

The literature shows that every process of agricultural trade is supported in ATSC research. For example, "Food" is identified as the keyword with the highest co-occurrence, indicating many scholars base their ATSC research on food as the research object. In addition, "System" is another frequently appeared keyword, implying researchers tend to study ATSC as a system. Moreover, recent years have seen many scholars exploring blockchain technology's applications in ATSC, mainly using blockchain to trace agricultural trade for food safety and environmental protection.

In summary, similar to other supply chains, ATSC is a phenomenon observed and concluded from economic activities, according to the author's understanding of supply chain. However, different from other supply chains, ATSC covers the process from agricultural production to consumption. This section has accomplished the research objective of propose the view of agricultural trade supply chain as set out in the research objectives.

CHAPTER V

SIMULATION OF THE APTFSC

This chapter introduces the cash flow status of the APTFSC simulation model generated by VENSIM. It presents the cash flow situation of various participants under both generic and specific situation. Additionally, it also presents the changes in cash flow within the APTFSC by considering three representative agricultural products. This chapter contributes to achieving the research objective of uncovering the current state and issues within the APTFSC.

General model

We assume day is unit for time and time step is 1 in this model, which means each change in the model spends 1 day and data for each day is recorded according to the model. The day starts at 0 and ends at 720. The integration technique is Euler. After running setup model which following above information, we output the results for the cash flows of farmers, trading manufacturers, and distributors and draw into Figure 28. The cash flows of three participants increase during the period. The cash flow of distributors grew the fastest and far more than the other participants. The cash flow of farmers increases slowest whom trading manufacturers had a better rise than.

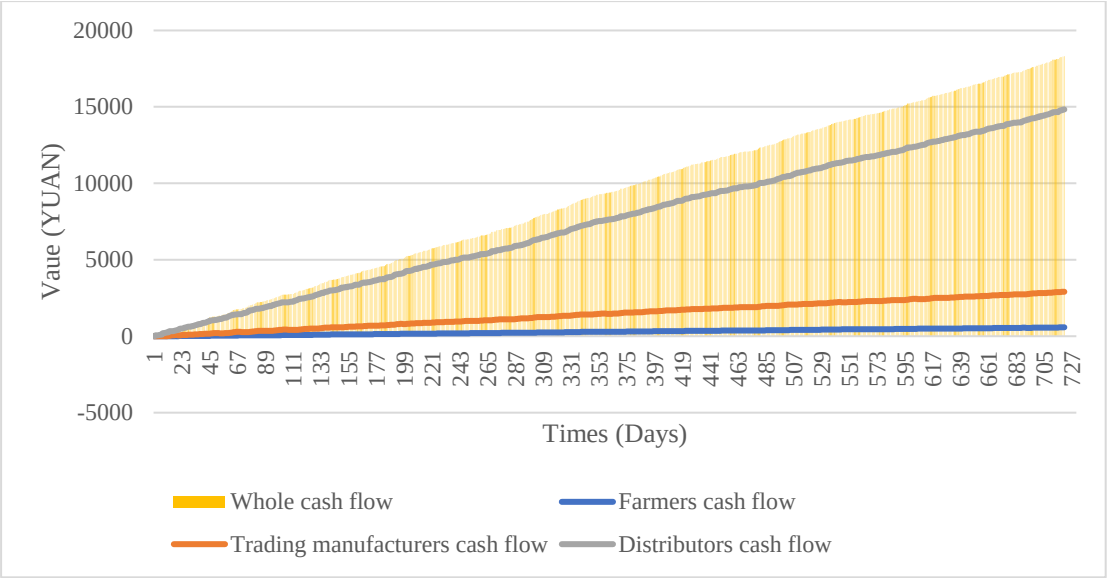


Figure 28 Cash flows of participants and total cash flow within setup model

We assume harvest delay and transport delay increases as a result of simulation that processes of production and trade are disrupted, and output Figures 29. With holding other variables, the cash flow of farmers showed a relatively large vibration. While there has been some impact on the pace of cash flow growth for trading manufacturers and distributors, both are still growing with total cash flow. However, when both variables of delay are raised, the growth of demand will aggravatedly deteriorate the cash flows and show a downward trend; And selling price significantly show negative in the cash flow of distributors. In addition, we found that neither selling prices nor demand intuitively changed the magnitude of cash flow fluctuations in the supply chain.

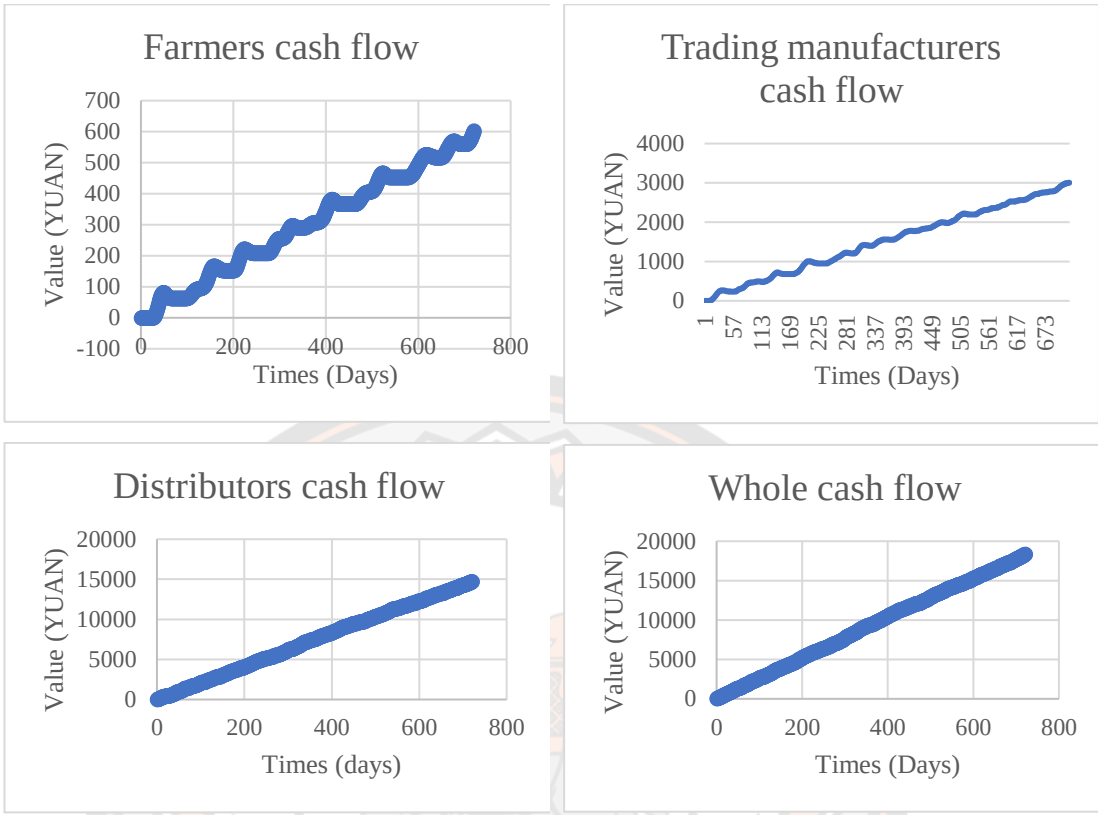


Figure 29 Cash flows of participants and the total within changed delay model

In addition, we have set up an extreme case with shown as Figure 30, that is, exchange rates are extremely unfavorable to trading manufacturers and found that when exchange rate fluctuations are within a reasonable range, only the cash flow of traders and manufacturers will be affected. However, when exchange rates severely affect the income of traders and manufacturers, this effect will lead to a decrease in farmers' income through a decrease in order quantities, ultimately affecting the farmers' cash flow. But distributors will not be affected by fluctuations in exchange rates.

Moreover, when adjusting tariff rates, we found that changes in tariffs only affect the cash flow of trade manufacturers and do not affect distributors and farmers. When the tariff rate reaches 80% or more, the cash flow of trade manufacturers no longer increases in the model.

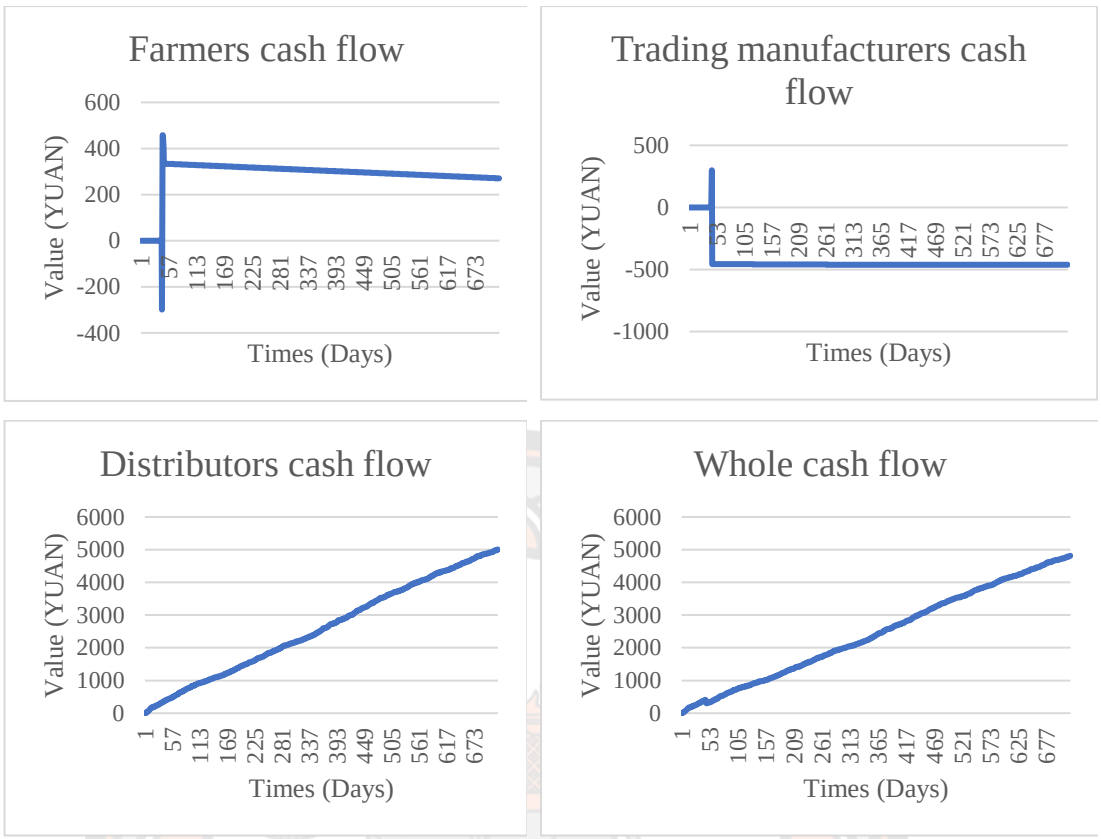


Figure 30 Cash flows of participants and the total with extreme bad exchange rates

After customizing the model settings to the case of durian, rice, and tapioca, the following cash flow chart can be obtained.

Durian case

Modify the model based on the characteristics of the durian case to obtain a durian trade supply chain. In this model (Figure 31), the whole cash flow of the three participants continues to increase. Similar to the originally setup model, the distributor's cash flow growth rate is the fastest, followed by the trade manufacturer, and the farmer's cash flow growth rate is the slowest. When we increased the values of harvest delay and transportation delay, the cash flow of the three participants also fluctuated to varying degrees, similar to the original model.

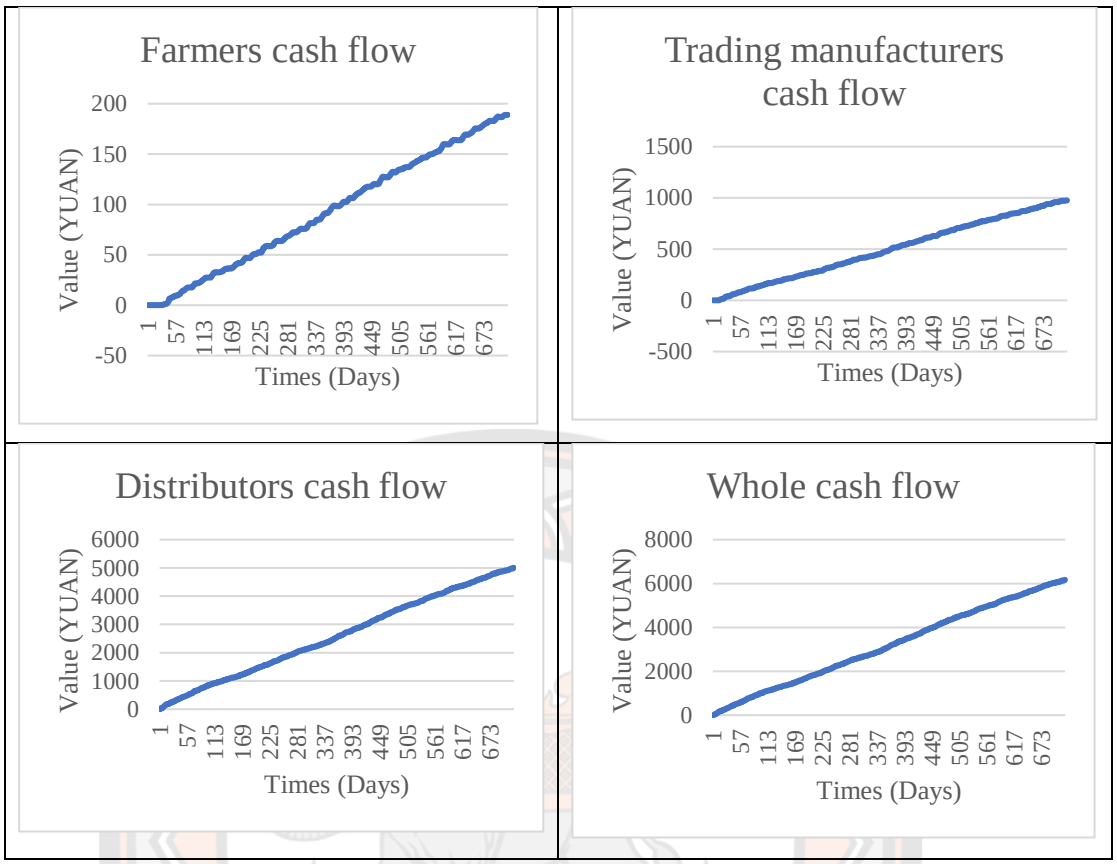


Figure 31 Cash flows of participants and the total in durian case

Rice case

Modify the model based on the characteristics of the rice case to obtain a supply chain model for rice trading (Figure 32), in which the whole cash flow of the three participants continues to increase. Unlike other models, we set the tariff change pattern to make the cash flow of the trading manufacturer show a stepwise increase. In addition, because we set the numerical references for demand and selling price based on actual conditions, the cash-in and cash flow values of the three participants are different.

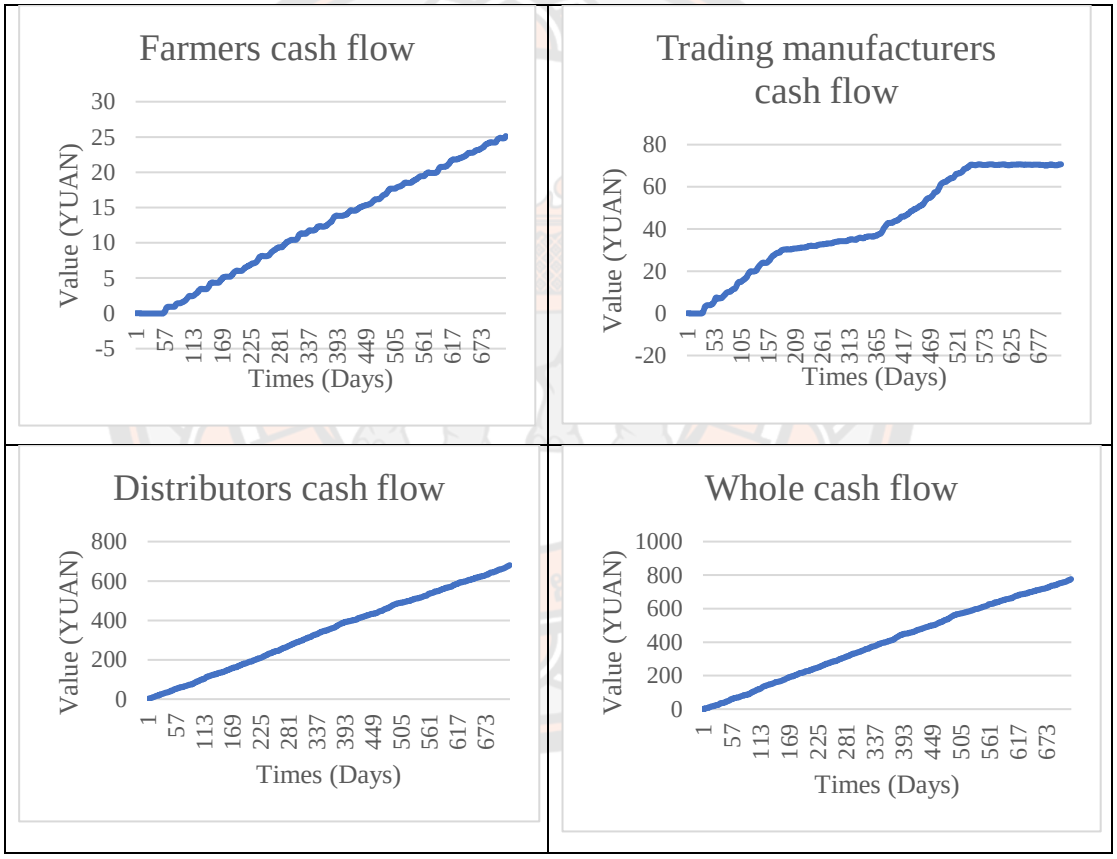


Figure 32 Cash flows of participants and the total in rice case

Tapioca case

Modify the model based on the characteristics of tapioca to obtain a trade supply chain model for tapioca (Figure 33). In this model, the cash flows of the three participants are not significantly different from the durian case study. Among the cash

flows of the three participants, the fastest growing are the distributors, followed by the trading manufacturers and farmers. Tariffs and exchange rates also only affect the trading manufacturers.

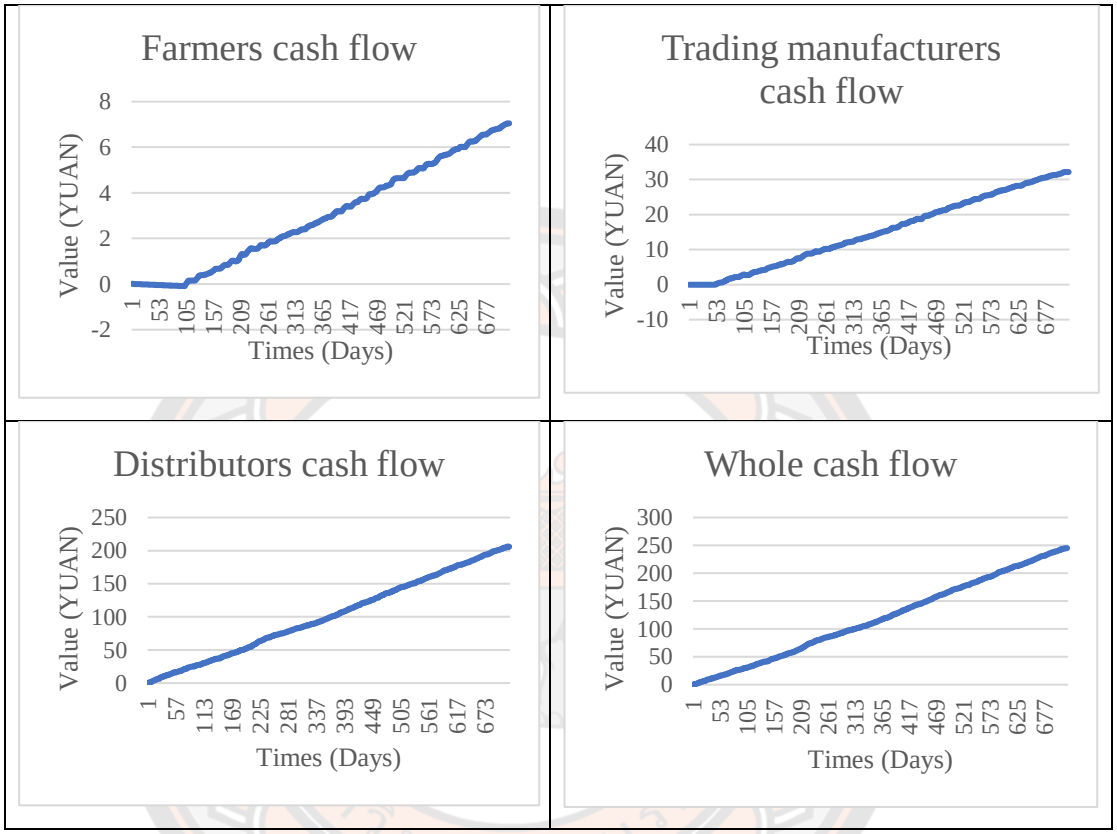


Figure 33 Cash flows of participants and the total in tapioca case

Existing limitations or problems

For the three participants in the model, the upstream participant's cash flow growth rate is much slower than the downstream participants. This may reflect the following issues:

1. The upstream participant has a lower profit margin. As the starting point of the supply chain, the upstream participant often faces more uncertainties and risks, with profit margins being squeezed.

2. The upstream participant faces greater operating cost pressures. Costs such as raw material procurement, storage, and transportation are higher, leading to a slowdown in cash flow growth.

3. The downstream participant has greater bargaining power. The downstream participant is closer to the end market and has greater pricing power, which can push down procurement costs for the upstream.

4. There is overcapacity among upstream participants. Oversupply leading to lower prices for the upstream participant's products, and weak revenue growth.

5. The downstream participant sees significant economies of scale. Larger downstream firms enjoy significant economies of scale, lowering costs and increasing profits.

6. The downstream participant occupies a higher position in the industry chain. The higher the position in the chain, the greater the value-add obtained.

7. Downstream industry growth outpaces upstream. Rapid growth in the downstream industry drives cash flow growth.

After adding the "delay" variable, the upstream participant's cash flow shows greater fluctuation, while the downstream participant's cash flow remains relatively stable. This may reflect:

1. The upstream participant faces more uncertainty. The delay increases the operational risks and uncertainty for the upstream, leading to more volatile cash flows.

2. There are issues with the upstream participant's inventory management. The delay can cause backlogs in upstream inventory, increasing financial pressure and causing fluctuations in cash flow.

3. The downstream participant has greater risk tolerance. Larger downstream firms can spread risks, and will not see big fluctuations from a single delay.

4. The downstream participant has better cash management. More disciplined financial management downstream ensures continuity of working capital.

5. Demand for downstream products is more stable. Downstream demand from end consumers is relatively stable, and won't fluctuate much from a small delay.

6. The downstream participant has greater bargaining power. Downstream can require the upstream to bear some additional costs to ensure stable cash flows.

7. Differences in supply chain flexibility. The adaptability to delays differs upstream versus downstream, with more elasticity downstream.

I simulated another extreme scenario where the exchange rate was highly unfavorable for the manufacturer and found that when exchange rate fluctuations were within a reasonable range, it only affected the cash flows of the trader and manufacturer. However, when the exchange rate severely affected the income of the trader and manufacturer, this impact led to a decrease in order quantity that resulted in lower income for the farmer, ultimately impacting the farmer's cash flow. But the distributor was not affected by exchange rate fluctuations. This reflects the following issues:

1. When exchange rate fluctuations are within a reasonable range, the main impact is on the cash flows of the trader and manufacturer. This indicates the trader and manufacturer face direct exchange rate risk.

2. But if exchange rates severely affect the income of the trader and manufacturer, it further impacts the farmer's income and cash flow through reduced orders. This shows there is a ripple effect between upstream and downstream.

3. The distributor is not affected by exchange rate fluctuations, indicating limited exposure to exchange rate risk.

This may reflect:

1. The trading manufacturer are directly involved in international trade, facing exchange rate risks.

2. There is a risk transmission mechanism from downstream to upstream in the supply chain.

3. The distributor only deals with domestic sales, not directly facing exchange rate risk.

4. Different supply chain stages have different capabilities to withstand exchange rate fluctuations.

5. Supply chain resilience needs strengthening to reduce the impact of exchange rate shocks.

When I incorporated the durian case into the simulation model, I found that the results were similar to the general model. This indicates that the durian export scenario from Thailand to China is close to the optimal state.

According to the simulation results after incorporating the durian export case, its high similarity with the general model can be explained as:

1. The supply chain participant structure for durian exports is similar to the general model, including farmers, traders, manufacturers and distributors.

2. The durian export supply chain from Thailand to China has high operational efficiency and smooth cooperation between parties.

3. The operation model of the durian supply chain has reached a relatively optimal state, consistent with the general theoretical model.

4. The durian supply chain may have formed a virtuous cycle, with reasonable sharing of risks and benefits between upstream and downstream.

5. Durian exports are large and stable in volume, allowing supply chain participants to benefit from economies of scale.

6. Durian supply chain participants have certain risk tolerance capabilities.

7. The differences between the durian supply chain and the theoretical model are limited, with no major structural issues.

Therefore, it can be considered that under the durian export supply chain from Thailand to China, it has achieved or is close to the optimal state, with high coordination and smooth operations across links. But continuous improvements are still needed to prevent unreasonable fluctuations.

When I incorporated the rice case into the simulation model, I found that the cash flow fluctuations of upstream participants were significantly higher than downstream participants. In addition, due to the impact of China's rice import quota, when the quota was exceeded and high tariffs had to be paid, the trading manufacturers' cash flow was severely affected. Fortunately, this tariff impact did not significantly influence the upstream participants or downstream participants.

My analysis based on the simulation results of the rice case is:

1. Upstream participants (farmers) have higher cash flow volatility than downstream (traders, manufacturers, distributors). This may be because:

- Upstream faces uncertainties directly such as yield, prices etc.
- Downstream has larger scale to diversify risks.
- Downstream has more disciplined financial management and stable cash operations.

2. China's import quota policy severely impacts traders' cash flows. This reflects:

- Traders directly face risks from changing government policies.

- Over-quota tariffs increase exchange rate risks for traders.

3. This tariff shock did not significantly transmit upstream or downstream. This implies:

- Traders have some risk isolation capabilities.

- Supply chain coordination between upstream and downstream needs improvement.

Overall, the rice supply chain faces many risks like yield fluctuations and policy changes. The linkage mechanism between upstream and downstream needs to be improved, to enhance resilience against external shocks. Also, key nodes should strengthen risk management.

When I incorporated the tapioca case into the simulation model, I found that the cash flows of upstream and downstream participants were similar to the durian case. But it is worth noting that the upstream participants' cash flows decreased before increasing. Considering the differences between the tapioca and durian cases, I suspect this is related to tariffs.

My analysis based on the tapioca case simulation results is:

1. The changing trends of upstream farmers' and downstream participants' cash flows are similar to the durian case, generally stable.

2. But upstream farmers' cash flows decreased before increasing, different from the durian case.

3. Considering tapioca exports to China require tariff payments, unlike durian, this may cause the initial decrease in upstream cash flows.

4. This reflects that tariff policies directly impact upstream farmers' income, but the impact is limited.

5. The tapioca supply chain has stronger resilience against tariff shocks.

6. But upstream remains the most vulnerable link, tariff adjustments would damage farmers' interests.

7. The interest linkage between upstream and downstream needs strengthening, to improve overall supply chain resilience against policy changes.

In summary, the tapioca supply chain operates relatively smoothly, but farmers' interests need attention. To enhance supply chain resilience, all parties need to share risks and jointly respond to external shocks and policy changes.

Overall, this section accomplished the second research objective. The case analysis shows that upstream and downstream participants play different roles in the supply chain, leading to differences in the risks and cash flow characteristics they face. Specifically, upstream farmers directly encounter uncertainties like yield and prices, facing higher operating risks and cash flow volatility. Meanwhile, downstream firms are larger in scale, and can diversify risks through economies of scale, while ensuring continuity of cash flows through financial management. When external shocks like policy changes occur, the upstream cash flow is negatively impacted first, reflecting that upstream is the most vulnerable link in the supply chain. However, if the shock further transmits downstream, it can also indirectly affect downstream through reduced orders. Therefore, improving the overall supply chain's resilience against external shocks requires strengthened interest alignment and coordination between upstream and downstream participants to jointly share risks. Only in this way can each link benefit from supply chain collaboration, ensuring smooth operation and sustainable development of the entire supply chain.

Improvement and innovation for the ATPFSC

In order to accomplish the third research objective, this section provides some solution strategies based on financial products or financial services.

For upstream farmers, the fear of yield and price uncertainties is a significant concern. Primary producers interact with a market characterized by price volatility caused by myriad factors ranging from local weather conditions to international trade policies. Financial instruments like derivative contracts, including forwards, futures, options, and swaps, serve as effective hedges against these price fluctuations. For instance, grain farmers in the Midwest. They might use futures contracts on their crops to secure a price for their harvest months in advance. This contract allows them to manage their risk concerning potential price changes between the time of planting and harvesting. By effectively locking in prices ahead of time, farmers can attain a degree of financial security, making planning and budgeting significantly less challenging. On

the other hand, downstream firms keen on maintaining cash flow stability can find solace in trade finance services. Instruments such as invoice factoring, supply chain finance, and trade credit insurance can ensure a firm's efficient receivable and payable management. Big-box retailers such as Walmart illustrate the power of supply chain finance programs. Through these programs, the retail giant's suppliers can get paid immediately by a finance provider based on payable invoices. This method offers dual benefits – it ensures smooth cash flows for Walmart, while also providing their suppliers with immediate liquidity. Insurance products, in addition, can offer robust protection to both upstream and downstream supply chain entities against external shocks, such as natural disasters or policy changes. From crop insurance that safeguards farmers against the risks of a bad harvest due to unforeseen weather changes, disease outbreaks, or pests, to business interruption insurance that shields downstream firms from unexpected disruptions reducing orders, insurance policies can serve as a financial buffer against unforeseen adversities. During the widespread disruption caused by COVID-19, for instance, many businesses managed to claim compensation for lost profits under their business interruption insurance policies, showcasing their importance in turbulent times. Additionally, specialized financial advisory services can guide businesses through their cash flow structure, helping identify potential risk spots. Such advisory services design tailor-made solutions to optimize financial inflows and outflows. Firms like McKinsey or BCG offer risk management consulting, helping corporates develop risk management strategies that build resilience and value.

In conclusion, financial products and services can perform critical roles in mitigating supply chain risks. The appropriate choice and combination of these products should be made considering the businesses' nature, their operational practices, respective market dynamics, and risk tolerance levels. By strategically leveraging these tools alongside operational risk management strategies, firms can enhance their resilience and navigate through volatile market conditions with greater confidence.

CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

This chapter interprets the meaning of the research findings. It provide the view of ATSC and Sustainable ATSC. And explains the current state of the Thailand-China APTFSC based on the results generated from simulation modeling. Additionally, this chapter provides recommendations for governors, supply chain designers, and financial institutions, and presents prospects for future research in this field. This chapter successfully achieves the research objectives, including proposing solutions.

The inspiration for establishing the ATSC

This paper reviews the results of a study in the field of the ATSC from 2012 to 2021 and uses CiteSpace to demonstrate the evolution and future trends of these results. The content of this paper mainly includes the following aspects: (1) Countries analysis provides published quantity in the world. While the United States has always been a leader in researching ATSC, we cannot ignore the contributions of other countries. As Chinese researchers contribute more articles in this field, we can think that China will use the research of the United States, the United Kingdom, Italy, and other countries as a basis to make more contributions to the development of the ATSC field in the future. (2) Keywords analysis displays highly mentioned and related keywords and calculate keywords with the strongest citation bursts. The keywords of “supply chain”, “system”, “agriculture”, and “life cycle assessment” are representative in the ATSC. After 2015, the keywords with the strongest citation bursts shows closed relationship with factors endowments in research filed of international trade theory, such as water, land, and forest. (3) Cited author analysis regularize all author in the ATSC and account the cited mount and centrality of the authors. International organizations, such as the FAO and World Bank, act important role in the ATSC, which provide plenty of reports and data with massive influence. (4) Reference analysis arranges 13 clusters, and we describe the first five representative clusters. The collected research mostly mention content about ways to deal with environmental issue such as emission, land use, footprint, etc.

This section defines a new research area and introduces the developing situation in a decade of 2012-2021. With the outbreak of the COVID19 and the emergence of extreme weather, there is a growing concern about environmental issues. In the process of agricultural production and trade, there is no doubt that ecological and environmental issues have become the most concerned topics for researchers. Meanwhile, research in the ATSC field is also passionate about solving environmental problems. Plenty of articles consider the corresponding indicators of environmental problems from the process of production, trade, and consumption of agricultural products. Agricultural trade, whether production or trade, is difficult to manage. However, as technology advances, scientific tools make it easier for researchers to obtain indicators of production and trade activities. From the results of this study, many scholars conduct various environmental issues research through the characteristics of the ATSC. All in all, the ATSC is still covering an area of supply chain management, and the object of management is agricultural trade. However, in the past decade, due to the extreme environment on the earth, most scholars tend to focus on carbon emissions, ecosystems, soil erosion and other environmental problems. In addition, we found considerable keywords that mentioned about related to factor endowment which is sector of international trade theory. Quantifying those factors like land, water, forest can be contributive. However, we believe there are still unexplored areas that remain unnoticed, such as whether the type of agricultural product affects its emissions from production, trade, and consumption. From the perspective of citation bursts keywords, we suggest that researchers who focus on ATSC can focus on land use change, supply chain design, and forests. From the perspective of previous contributions, it is necessary to view articles from the U.S. scholars in order to quickly and comprehensively understand ATSC. To further explore more cutting-edge research directions, we can consider referring to articles from Chinese scholars.

In summary, ATSC can be viewed as a combination of agricultural supply chains and trade supply chains. From a sustainability perspective, it encompasses the production, processing, storage, transportation, trading, and marketing of agricultural products. Additionally, our research on ATSC offers the following insights:

First, blockchain technology can improve supply chain transparency and traceability, promoting sustainable agriculture trade. Product and information flows can be publicly monitored along supply chains through blockchain.

Second, consumer preference for sustainable and eco-friendly products is increasing, creating powerful market opportunities for sustainable agricultural trade. As consumers become more ethically and environmentally conscious, demand for sustainable products will continue to rise.

Third, corporate zero deforestation commitments help improve supply chain sustainability by reducing deforestation impacts. More and more companies are committing to eliminating deforestation in their supply chains and production. By rigorously monitoring these commitments and lowering risks, businesses can make their supply chains more sustainable and eco-friendlier.

Furthermore, the future development of the bioenergy market brings opportunities for agriculture trade supply chains. As bioenergy technologies advance and adoption increases, markets for agricultural feedstocks and products will expand, spurring supply and demand sides of the chains.

Finally, farm advisors can assist farmers in adopting more sustainable production practices, thereby enhancing supply chain sustainability. With their expertise, farm advisors can provide tailored advice to help farmers choose and implement sustainable agriculture practices according to specific needs and conditions.

Lessons learned from simulations

The simulations reviews situation that Thai agricultural product exported to China and simulates the material flow and cash flow of each participant. The bullwhip effect in the ATSC supply chain impacts cash flows differently for each participant, with excessive selling forecasts leading to magnified orders and increased inventory and production costs. Upstream participants experience slower cash flow growth compared to downstream participants, which can affect their potential protection against risk and reinvestment options. The comparison of cash flows can provide evidence for why Chinese investment is increasing in the source of agricultural product trade in the ATSC between Thailand and China. This part discusses the cash flow dynamics in the durian, rice and tapioca trade supply chain between China and

Thailand. Specifically, cash flow growth rate of downstream participants in the supply chain is much faster than that of upstream participants. This means that distributors and retailers will have better cash flow than farmers and primary processors. Moreover, fluctuations in exchange rates have little impact on the cash flow of participants. Although exchange rate changes may increase the income of some participants, the impact is negligible. In addition, tariffs have a major impact on the cash flow of traders and upstream suppliers, but basically no impact on distributors. This shows that countries imposing tariffs do not really consider the situation of export country participants when setting tax rates. Otherwise, due to the faster cash flow growth rate of downstream participants and the smaller impact of tariffs on them, their bargaining power in the supply chain is stronger. In contrast, the cash flow of upstream participants such as farmers and primary processors is more easily affected, and their bargaining power is weaker. Finally, harvest delays or transport delays will increase the uncertainty of cash flow for supply chain participants, especially upstream participants and we believe the reasons are followed: 1) Agricultural products have a long growth cycle and harvest time is difficult to predict precisely. This causes instability in the cash flow of upstream suppliers such as farmers. For example, if there is a delay in harvesting due to weather problems, the cash flow of farmers will be greatly affected. 2) The products of upstream suppliers usually need to be transported to downstream through various intermediate links, which introduces more uncertainties. Any transportation delay may affect the cash flow of primary processors or traders. The impact on distributors or retailers is relatively small because they have other channels to obtain products. 3) Downstream participants usually have more types of products and trading partners, which disperses risks to some extent and reduces fluctuations in cash flow. Upstream participants have single products and trading partners, so cash flow dynamics are more direct and more easily affected by individual factors. 4) When delays occur, downstream participants can take measures to shift some of the losses, while the losses of upstream participants are usually difficult to shift and must be borne by themselves. This also increases the uncertainty of upstream cash flows. In fact, there are also scholars who have studied the supply chain of agricultural products and come to similar conclusions to the conclusions of this study.

Through discussion on the trade credit issues in China's agricultural industry chain, it is found that downstream companies have shorter payment terms, and it is easier to expand their business scale, while upstream sellers have longer payment terms. It can be speculated that the cash flow of downstream participants grows faster, showing a phenomenon of cash flow gathering downstream (Jin et al., 2020). Specifically, in the agricultural product industry chain, upstream farmers and primary processing participants have longer product sales cycles, while downstream end retailers have shorter product sales cycles. Upstream participants need longer time for production and operation cash turnover, and cash inflow is slow; downstream participants have fast cash inflow and short cash turnover cycle. This leads to differences in cash liquidity between upstream and downstream. Moreover, downstream participants have stronger pricing power to obtain higher profit margins and profitability. While upstream participants have weaker pricing power, lower profit margins and profitability. This also makes the cash inflow and accumulation speed of downstream participants greater than that of upstream participants. In addition, the cash inflow of upstream participants is relatively slow, but they need to pay for procurement, production costs, and provide a certain credit period to downstream participants. This increases the pressure on upstream participants' cash outflow, making upstream participants' cash liquidity worse. Downstream participants can obtain credit line from upstream participants, which helps cash flow management and utilization. Therefore, there are significant differences in cash liquidity and structural imbalance between upstream and downstream in China's agricultural industry chain, showing a phenomenon of cash flow gathering downstream and faster growth of downstream participants' cash flow. This increases the operating pressure on upstream participants and needs to be improved.

By discussing the formation factors of agricultural producer organizations in China, it can be found that the needs and market opportunities of downstream buyers can promote the growth of agricultural producer organizations, thus indicating that the expansion of downstream players can promote the development of the entire supply chain (Luo et al., 2018). Specifically, the demand of downstream buyers can create opportunities to sell products and encourage producers to combine to meet these opportunities. For example, large orders from food processing companies can encourage small farmers to organize to ensure quantity and quality. Then, downstream

participants often have stronger market identification and development capabilities. They have a clearer understanding of consumer demand and market potential. This can help upstream producers identify opportunities and cooperate to seize opportunities. Moreover, downstream enterprises also have greater economies of scale. They can provide larger orders and more stable income for well-organized upstream organizations. This further motivates the organization of upstream producers. In addition, downstream enterprises can also help upstream producer organizations in various ways, such as organizing training, providing financial support, etc. This accelerates the growth of upstream producer organizations. Therefore, the argument is very accurate. The participation and support of downstream enterprises play an important role in promoting the organization of upstream producers, integrating the industrial chain, and enhancing competitiveness. This also shows that to promote the development of an industry, we cannot only focus on a single industrial link, but must focus on the synergy and development of the industrial chain.

However, the study is still innovative in that it increases trade activity and focuses on two important factors in trade activity--- exchange rates and tariffs. And the confidence level in the simulation results would depend on the specific parameter values, mathematical relationships, and assumptions used in constructing the system dynamics model. The document mentions the model parameters would be set based on literature review or assumptions, rather than empirical data. So there would be some uncertainty in the quantitative outputs. However, the model could still provide valuable qualitative insights into the dynamics of financial flows in this supply chain context. Properly documenting the assumptions and limitations underlying the simulation model could help communicate the appropriate level of confidence in the results.

Overall, the simulation modeling appears to be an appropriate approach to meet the stated objectives, pending proper explanation of the model construction and limitations. The results could highlight financial flow issues and inform targeted recommendations, while noting that quantitative estimates may have uncertainties.

Conclusion

This research conducted an in-depth investigation of the agricultural product trade financial supply chain between Thailand and China using a systematic process comprised of literature review, bibliometric analysis, simulation modeling experiments, and targeted recommendations grounded in financial supply chain management approaches. The study began by establishing the theoretical foundation surrounding relevant concepts like agricultural trade supply chains, financial supply chains, and financial flows through a comprehensive review of scholarly literature. Following this, bibliometrics techniques were utilized to analyze patterns in previous publications related to agricultural trade supply chains over the past decade. CiteSpace software facilitated the bibliometric analysis which led to proposing a clear view of the agricultural trade supply chain field based on examining publication trends, citations, keywords, contributors, and research hotspots.

Equipped with fundamental knowledge of agricultural trade supply chains, the research progressed to developing a simulation model of the agricultural product trade financial supply chain between Thailand and China using system dynamics modeling principles in Vensim software. The model encapsulated the financial and material flows between key supply chain participants including farmers, trading companies, distributors and end consumers. Various simulation experiments were carried out through adjusting model variables related to delays, disruptions, exchange rates, tariffs and other parameters. The simulation findings revealed vulnerabilities and imbalances in financial flows within the supply chain, particularly for upstream participants like farmers. This dynamic modeling approach allowed the research to fulfill the objective of illustrating financial flow limitations in the Thailand-China agricultural trade context to address the second research question.

Finally, the research put forward specific recommendations aligned with financial supply chain management thinking to improve the agricultural trade financial supply chain between Thailand and China. The suggestions responded directly to the issues and insights highlighted through the simulation modeling, providing targeted interventions like financial instruments, government policy changes, supply chain collaboration, and customized financial services to strengthen the financial flows. The recommendations successfully integrated knowledge from across the literature review,

bibliometric analysis, and simulation studies to prescribe improvements grounded in both theory and data-driven models. Thereby the research satisfied the third objective and research question regarding how financial approaches can optimize the agricultural trade financial supply chain.

While this study delivered a robust investigation using complementary techniques, future efforts could potentially validate the simulation models with empirical data, explore personalized recommendations for specific agricultural sectors, investigate collaborative optimization between financial institutions and supply chain partners, and expand the geographical scope. Nevertheless, within its stated scope focused on Thailand-China agricultural trade, this research made notable contributions in proposing a view of agricultural trade supply chains, illuminating financial flow vulnerabilities, and prescribing improvements through financial supply chain management - guided at each stage by the interlinked research questions, objectives, and recommendations. There remains extensive potential to further advance knowledge at the intersection of agricultural trade, supply chain management, and financial flows which this study has helped lay the foundations for.

Recommendation

Recommendations to governors are followed by:

1. Reducing the tariff burden on upstream supply chain participants, especially primary processors, and farmers, which can improve their cash liquidity and enhance their bargaining power.

Tariffs are a way to increase producer costs and consumer prices. Reducing or exempting tariffs can directly lower producer costs, especially for upstream producers such as primary processors and farmers. This can significantly reduce cost pressures and increase profit margins. Reducing or exempting tariffs is equivalent to increasing the income and profits of producers. This can increase their cash flow, improve liquidity, and give them more funds for production, operations and investment. Adequate cash flow and lower costs can give producers stronger bargaining power and pricing authority in the market. Because they have more leeway to determine product prices without being passive due to high costs. This also means they face less price risk. Increased cash flow and lower costs can encourage producers to make new investments

to increase productivity. This ultimately also benefits the industry and consumers. Therefore, reducing tariff burdens on upstream producers can enhance their cash flow, reduce cost pressures, strengthen their bargaining power and initiative in the market, and benefit investment and industrial development through multiple channels.

2. Providing subsidies or insurance mechanisms to reduce the risk of losses and cash liquidity caused by harvest delays or transportation delays for upstream participants.

Subsidies and insurance can share the losses and risks to producers caused by delayed harvests or transportation. This reduces the overall risk faced by producers and stabilizes cash flow. Government subsidies and insurance can to some extent guarantee the income of producers and avoid a sharp drop in income due to external risk factors. This is conducive to the continuity and sustainability of production operations. Subsidies and insurance payments can directly provide financial support to producers to offset losses and maintain cash flow liquidity. This can avoid disruption of production or operations by producers due to cash flow problems. Government support can reduce producers' credit risks and financing costs. Financial institutions are more willing to provide loans to producers who receive government support or guarantees and can provide loans at lower interest rates. This also helps producers obtain financing and reduce costs. Risk sharing and stable cash flow can encourage producers to make new investments to develop production. The government's direct financial support can also be used for investment to achieve industrial upgrading. Therefore, the government's subsidies and insurance mechanisms can provide cash flow support, share risks, reduce costs, promote investment, and ultimately achieve industrial development for upstream producers through multiple channels.

3. Establishing a more scientific and reasonable tariff system, avoid excessive reliance on import taxes, and take into account the interests of participants in exporting countries.

Excessively high import tariffs will cause dissatisfaction and retaliation from exporting countries, leading to trade friction. Reasonable tariff levels can avoid these problems and help maintain the free trade system. Excessively high import tariffs will increase the cost of purchasing imported products and affect the competitiveness of domestic industries in the international market. Reasonable tariffs are conducive to

obtaining advanced imported technologies and raw materials to support the development of export industries. Excessively high tariffs will increase the cost and price of domestic products, which may lead to inflation and affect the overall economy. Reasonable tariff levels are conducive to controlling prices and promoting steady economic growth. Tariff revenue depends heavily on external factors and may fluctuate significantly due to changes in the international market. The government should not rely too heavily on tariff revenue and needs more broad and stable sources of fiscal revenue. Meanwhile, considering the interests of exporting countries is mainly to avoid retaliatory tariff policies that could affect their own exports. Reasonable tariff policies need to comprehensively consider the policy environment and interests of importing countries and exporting countries and adopt gradual and coordinated reform strategies. Listening too much to the interests of one party may provoke a backlash from trading partners, which is detrimental to all parties.

Suggestions to supply chain designers are followed by:

1. Expanding the sales channels and customer base of upstream supply chain participants and reducing the risk of dependence on a single trading partner, which improves the stability of upstream cash flow.

Over-reliance on a single customer or trading partner can pose great risks to upstream suppliers if the customer or trading partner encounters financial difficulties or terminates cooperation. Expanding other customers and channels can diversify such risks. Different customers and channels will have different sales peak and off-peak seasons. If different types of customers and channels can be expanded, sales revenue can be obtained in different periods to stabilize the cash flow. This is very important for the cash flow management of upstream suppliers. If the upstream supplier is too dependent on a single customer, that customer will often take a dominant position in price negotiations, which will inhibit the profit margin of the upstream supplier. Expanding multiple customers and channels can enhance the bargaining power of upstream suppliers and obtain higher operating profits. Different types of customers may face different demand changes. If different types of customer base can be expanded, it can offset the demand fluctuations of each customer to a certain extent, thereby reducing the risk of inventory backlogs and price drops. Therefore, expanding sales channels and customer base can reduce the risks of upstream suppliers, enhance

the stability of cash flow, increase bargaining power, and reduce inventory risks. These are beneficial to the long-term stable development of upstream suppliers.

2. Increasing collaboration between upstream and downstream partners and improving information transparency can help all parties better predict changes in market demand, avoiding cash flow problems that may arise from inaccurate demand forecasts.

Information sharing allows partners to develop a more holistic and precise understanding of market conditions, enabling enhanced demand forecasting accuracy. With siloed operations, individual parties have limited visibility into overall market dynamics, hampering predictive capabilities. And synchronized sales and operations planning helps align peak and off-peak selling seasons between partners. Without coordination, upstream producers may over-produce during downstream partners' off-peak periods, straining cash flows and inventory levels. Moreover, close cooperation enables rapid responsiveness to change in market demand. Partners can quickly adjust production and purchasing plans to minimize losses from demand forecast errors. Uncoordinated responses are slower and less effective, resulting in greater damages. Also, collaboration improves resource optimization and lowers total operating costs through joint raw materials procurement. This also contributes to more stable cash flows. Therefore, strengthening partner collaboration and data transparency boosts the accuracy of demand forecasts, accelerates responsiveness to market shifts, enables resource optimization, and helps establish reliable cash flows by avoiding problems caused by suboptimal predictions. Overall, inter-partner dynamics have a substantial impact on supply chain stability and financial performance. Improved coordination and visibility are instrumental to risk reduction and value creation across networks.

3. Supply chain designers should establish a more scientific and reasonable tariff system, avoid excessive dependence on import tariffs, and also consider the interests of exporting countries.

Excessively high import tariffs will lead to trade barriers, prompting trading partners to take retaliatory tariff measures, leading to trade disputes and frictions, and even triggering trade wars. This is not conducive to the development of global trade. Moderate tariff levels can promote fair trade and balance import and export trade. And excessively high import tariffs will push up domestic commodity prices, causing higher

inflationary pressures and tightening controls. This will increase corporate costs and inhibit economic growth. Also, moderate tariffs are conducive to forming a stable global supply chain and avoiding excessive dependence or excessive isolation of a country or region. If tariffs are too high, the connections of the global supply chain will be broken, causing losses to all parties. In addition, the development of economies around the world depends on fair trade. Moderate tariffs can promote global trade growth and drive economic development in each country. Excessively high tariffs only provide short-term fiscal revenue, but in the long run, they will inhibit the economic development of trading partners and be detrimental to domestic exports. Finally, moderate tariffs are also conducive to safeguarding the interests of domestic export companies. Excessively high tariffs will lead to retaliatory tariffs, hitting export companies. When formulating tariff policies, the interests of export companies should also be balanced. Therefore, establishing a scientific tariff system, fully considering factors such as domestic inflation, global supply chain stability, and trade development in each country, while also considering the interests of domestic export companies, is conducive to promoting the development of international trade and common prosperity of all parties.

Suggestions to financial institutes are followed by:

1. Increase financing support for upstream supply chain participants, especially providing loans during the harvest season to alleviate their capital pressure.

Upstream supply chain participants such as agricultural enterprises usually have a long cash flow cycle, with a large time difference between income and expenditure, which can easily lead to capital gaps and increase financing difficulties. Financing support from financial institutions can fill this capital gap and meet their working capital needs. The income of upstream industries such as agriculture usually depends on uncontrollable factors such as weather, and income is difficult to accurately predict, which also increases the difficulty of funds management. Financing from financial institutions can provide a more stable source of funds and reduce the impact of income fluctuations. Upstream industries also face greater risks, such as natural disasters that can cause major losses. Financing support from financial institutions can increase their ability to resist these risks and avoid chain reactions caused by lack of funds. Financial institutions understand the operating characteristics and actual needs

of upstream companies, can provide more preferential and flexible financing products, reduce companies' financing costs, which is especially important during the harvest season. Financial institutions can also provide upstream companies with professional financial and risk management guidance to help them establish scientific capital management and expenditure plans, give full play to greater operating leverage, and help companies achieve sustainable development. Therefore, the support of financial institutions can provide a stable source of funds, share the capital pressure of upstream companies, improve their ability to resist risks and reduce financing costs, help upstream companies maintain normal operations, which is crucial to the stability of the entire supply chain. Moderate financial support can produce better leverage.

2. Developing agricultural futures and forward contracts to help participants hedge and avoid price fluctuations and cash flow risks.

Futures and forward contracts allow buyers and sellers to lock in transaction prices in advance to avoid the impact of future price fluctuations and achieve price preservation. This is especially important when agricultural product prices fluctuate greatly. Through futures and forward contracts, risks can be transferred to professional hedging participants, allowing agricultural producers and processors to focus on product production and sales. By locking in prices in advance, future sales revenue and cash flow can be estimated more accurately, which is conducive to enterprises conducting scientific fund management and production operations planning. Since prices and cash flows have been locked in, corporate income is more predictable, which can reduce the risks of financial institutions and motivate them to provide preferential financing conditions and reduce corporate financing costs. Futures and forward markets can also introduce new trading entities such as investment institutions and hedging funds, making the market more active and providing more hedging tools for companies to choose from. These professional institutions can also provide services to other companies that do not have professional hedging capabilities. The futures market allows more buyers and sellers to participate in the price discovery process, form prices in the open market, which can improve the scientific nature of agricultural product pricing mechanisms and make pricing more based on market supply and demand. Therefore, futures and forward contract markets can provide a more stable and predictable operating environment for agricultural product producers, processors,

sellers, and financial institutions. This helps coordinate and optimize the entire industrial chain. All parties can focus on their own core businesses to jointly promote the development of the industry.

3. Designing more suitable credit products according to industry characteristics and participant characteristics, such as developing lower interest rate or longer repayment period products for primary processors and farmers.

When participants have weaker financing ability. Providing more preferential credit products can lower their financing costs, meet the capital needs of production and operations, and enhance their competitiveness. Primary processing and agricultural production have longer cash flow cycles and greater fluctuations. Providing products with longer repayment periods and lower financing costs can match their cash flow characteristics and reduce repayment pressure. If participants have weaker sources and ability to repay, providing moderately preferential conditions can reduce their default risk, which also meets the risk preference of financial institutions. Excessively harsh conditions are difficult to guarantee and repay. Moderately preferential credit products can cultivate these participants' loyalty to financial institutions. They may continue to choose the financial institution's products after their operations improve. This is conducive to the long-term development of financial institutions. The primary industry and agriculture have a greater pulling effect on the entire economy. Financial support can help them develop and grow, which also indirectly benefits the development of related downstream industries and promotes balanced regional economic development. Also, many countries and regions attach great importance to supporting primary industry and agriculture. Preferential credit from financial institutions also meets the government's policy orientation, which is conducive to the relationship between financial institutions and regulatory agencies. Therefore, financial institutions design differentiated credit products for different participants to maximize the leverage effect of funds and support the development of the real economy. This is not only beneficial to the participants themselves, but also conducive to business expansion of financial institutions and implementation of industrial policies by the government. Industrial collaborative development requires financial impetus.

The recommendations made in the document for improving the agricultural trade financial supply chain are directly informed by the simulation results and aligned with findings from the literature review. The simulation results revealed that upstream farmers face more cash flow volatility and slower growth compared to downstream participants, consistent with previous research showing agricultural production faces yield uncertainty and price fluctuations that increase financial risks for farmers. To address this, the recommendations suggest using futures, options, insurance to help farmers manage the price and production risks highlighted. The simulation found tariffs disproportionately impact trading manufacturers' financial flows, aligning with literature noting tariffs increase producer costs and reduce incomes of upstream entities. Thus, the recommendations advise reducing tariffs and providing subsidies to alleviate the cost pressures on upstream participants evident in the results. Exchange rate changes exacerbated negative effects on upstream cash flows in the simulation, fitting with scholarly observations that exchange rate volatility introduces more risk for trade-focused companies like manufacturers. Hence, the recommendations include enhancing information sharing and forecasting to address the demand uncertainty risks reflected in cash flow volatility. Finally, the simulation showed farmers' cash flows are most sensitive to external disruptions, while literature reviews find downstream firms have more resources to withstand disruptions. Accordingly, the recommendations propose developing customized credit products and services to support different supply chain roles based on their cash flow profiles as seen in the modeling.

In summary, the suggested financial and supply chain management interventions specifically target the issues highlighted through the simulation experiments and corroborated by prior research. This aligns the recommendations closely to the simulation findings and literature review. The simulation modeling provided a dynamic analysis of financial flows across the agricultural trade supply chain, quantitatively revealing vulnerabilities and imbalances between different participants. This unique perspective informed recommendations like strengthening risk management for upstream farmers and developing customized financial services tailored to each supply chain role's needs, as evidenced by the model results. Varying exchange rates and tariffs in the simulations demonstrated their amplified negative impact on upstream cash flows, shaping recommendations around information sharing,

subsidies, and tariff adjustments to alleviate upstream cost pressures based on these specific insights. The model simulations highlighted the greater sensitivity of farmers' cash flows to external disruptions compared to downstream participants, uniquely guiding suggestions to use financial instruments like futures and insurance to safeguard farmers against production and price uncertainties. By incorporating real-world conditions through modeling specific agricultural products, the research lent authenticity and a practical dimension to the targeted recommendations. Finally, the combination of data-driven simulation modeling and literature review provided robust, evidence-based support for proposed interventions, with this integrated method strengthening their relevance. Overall, through quantitative simulations, real-world focus, and multi-faceted analysis, the research generated new insights that informed practical, customized recommendations to improve the agricultural trade financial supply chain.

Future research

China and Thailand have a long history of trade relations spanning centuries, primarily through maritime trade networks. In recent times, as both economies have grown rapidly and bilateral trade volumes have increased steadily, the demand for more sophisticated financial products and services to facilitate trade between China and Thailand has also risen. This is to help businesses in both countries reduce risks, improve efficiency, and support trade activities like financing, trading, and settlement.

Some examples of such financial instruments include insurance, letters of credit, bank drafts, foreign exchange derivatives, etc. In addition, China and Thailand can strengthen cooperation in finance, jointly develop innovative financial products, and promote greater convenience in trade as well as deeper bilateral economic collaboration.

In short, the growing trade relationship between China and Thailand in modern times calls for more advanced financial products and services to match the increasing scale and complexity of bilateral trade. Closer cooperation in finance between the two countries can help achieve this by fostering the creation of new financial products, supporting trade facilitation, and enabling further economic cooperation.

In the future, we believe that designing financial products based on the characteristics of different agricultural products can better guarantee the stability of agricultural trade supply chains. With advancements in technology, financial institutions can use intelligent products to understand and control agricultural trade supply chains more quickly and accurately. Supply chain finance products tailored to the characteristics of agricultural products will be an interesting field in the future.

REFERENCES

REFERENCES

Acharya, S. (2020). Instruments of International Commercial Contract.

Adhikari, J., Timsina, J., Khadka, S. R., Ghale, Y., & Ojha, H. (2021). COVID-19 impacts on agriculture and food systems in Nepal: Implications for SDGs. *Agricultural Systems*, *186*, 102990. https://doi.org/https://doi.org/10.1016/j.agsy.2020.102990

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action Control: From Cognition to Behavior* (pp. 11-39). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-69746-3_2

Ali, M. H., Chung, L., Kumar, A., Zailani, S., & Tan, K. H. (2021). A sustainable Blockchain framework for the halal food supply chain: Lessons from Malaysia. *Technological Forecasting and Social Change*, *170*, 120870. https://doi.org/https://doi.org/10.1016/j.techfore.2021.120870

Alves-Pinto, H. N., Newton, P., & Pinto, L. F. G. (2015). Reducing Deforestation and Enhancing Sustainability in Commodity Supply Chains: Interactions between Governance Interventions and Cattle Certification in Brazil. *Tropical Conservation Science*, *8*(4), 1053-1079. https://doi.org/10.1177/194008291500800414

Angeleanu, A., Keppler, T., & Eidenmüller, T. (2016). Effective stakeholder management in international supply chain projects. Proceedings of the 4th International Conference on Management, Leadership and Governance, ICMLG,

Aschemann-Witzel, J., de Hooge, I. E., Rohm, H., Normann, A., Bossle, M. B., Grønhøj, A., & Oostindjer, M. (2017). Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste – A multiple case study. *Journal of Cleaner Production*, *155*, 33-45. https://doi.org/https://doi.org/10.1016/j.jclepro.2016.11.173

Ashraf, S. A., Siddiqui, A. J., Elkhalifa, A. E. O., Khan, M. I., Patel, M., Alreshidi, M., Moin, A., Singh, R., Snoussi, M., & Adnan, M. (2021). Innovations in nanoscience for the sustainable development of food and agriculture with implications on health and environment. *Science of The Total Environment*, *768*, 144990. https://doi.org/https://doi.org/10.1016/j.scitotenv.2021.144990

Bahmani-Oskooee, M., & Kanitpong, T. (2018). Thailand's trade balance with each of her 15 largest partners: an asymmetry analysis. *Journal of Economic Studies*.

Bahmani-Oskooee, M., & Kanitpong, T. (2019a). Asymmetric effects of exchange rate changes on Thailand-China commodity trade: Evidence from 45 industries. *The Chinese Economy*, *52*(3), 203-231.

Bahmani-Oskooee, M., & Kanitpong, T. (2019b). Thailand-China commodity trade and exchange rate uncertainty: Asymmetric evidence from 45 industries. *The Journal of Economic Asymmetries*, *20*, e00130.

Baines, R. N., Manning, L., & Soon, J. M. (2017). Mycotoxin incidents associated with cereals: lessons learnt and risk reduction strategies. *Quality Assurance and Safety of Crops & Foods*, 1-16.

Bajželj, B., Quested, T. E., Röös, E., & Swannell, R. P. J. (2020). The role of reducing food waste for resilient food systems [https://doi.org/10.1016/j.ecoser.2020.101140]. *Ecosystem Services*, *45*, 101140. https://www.sciencedirect.com/science/article/pii/S2212041620300826

Baldwin, R. E. (2012). *WTO 2.0: Global governance of supply-chain trade*.

Bals, C. (2019). Toward a supply chain finance (SCF) ecosystem–Proposing a framework and agenda for future research. *Journal of Purchasing and Supply Management*, *25*(2), 105-117.

Berghuis, E., & den Butter, F. A. (2017). The transaction costs perspective on international supply chain management; evidence from case studies in the manufacturing industry in the Netherlands. *International Review of Applied Economics*, *31*(6), 754-773.

Bosona, T., Gebresenbet, G., & Olsson, S.-O. (2018). Traceability system for improved utilization of solid biofuel from agricultural prunings. *Sustainability*, *10*(2), 258.

Bräutigam, K.-R., Jörissen, J., & Priefer, C. (2014). The extent of food waste generation across EU-27: Different calculation methods and the reliability of their results. *Waste Management & Research*, *32*(8), 683-694. https://doi.org/10.1177/0734242x14545374

Bruckner, M., Fischer, G., Tramberend, S., & Giljum, S. (2015). Measuring telecouplings in the global land system: A review and comparative evaluation of land footprint accounting methods [https://doi.org/10.1016/j.ecolecon.2015.03.008]. *Ecological Economics*, *114*, 11-21. https://www.sciencedirect.com/science/article/pii/S0921800915000932

Buchmeister, B., Friscic, D., Lalic, B., & Palcic, I. (2012). Analysis of a three-stage supply chain with level constraints. *International Journal of Simulation Modelling*, *11*(4), 196-210.

Bustos, C. A., & Moors, E. H. M. (2018). Reducing post-harvest food losses through innovative collaboration: Insights from the Colombian and Mexican avocado supply chains. *Journal of Cleaner Production*, *199*, 1020-1034.

Buzby, J. C., & Hyman, J. (2012). Total and per capita value of food loss in the United States. *Food Policy*, *37*(5), 561-570. https://doi.org/https://doi.org/10.1016/j.foodpol.2012.06.002

Caniato, F., Gelsomino, L. M., Perego, A., & Ronchi, S. (2016). Does finance solve the supply chain financing problem? *Supply Chain Management: An International Journal*.

Caniato, F., Henke, M., & Zsidisin, G. A. (2019). Supply chain finance: historical foundations, current research, future developments. In (Vol. 25, pp. 99-104): Elsevier.

Cao, S., Powell, W., Foth, M., Natanelov, V., Miller, T., & Dulleck, U. (2021). Strengthening consumer trust in beef supply chain traceability with a blockchain-based human-machine reconcile mechanism [https://doi.org/10.1016/j.compag.2020.105886]. *Computers and Electronics in Agriculture*, *180*, 105886. https://www.sciencedirect.com/science/article/pii/S016816992033091X

Carnovale, S., Rogers, D. S., & Yeniyurt, S. (2019). Broadening the perspective of supply chain finance: The performance impacts of network power and cohesion. *Journal of Purchasing and Supply Management*, *25*(2), 134-145.

Casson, M. (2018). Economic analysis of international supply chains: An internalization perspective. In *The Multinational Enterprise* (pp. 139-149). Edward Elgar Publishing.

Charatsari, C., Lioutas, E. D., Papadaki-Klavdianou, A., Michailidis, A., & Partalidou, M. (2022). Farm advisors amid the transition to Agriculture 4.0: Professional identity, conceptions of the future and future-specific competencies. *Sociologia Ruralis*, *62*(2), 335-362. https://doi.org/https://doi.org/10.1111/soru.12364

Charvet, F. F., Cooper, M. C., & Gardner, J. T. (2008). The intellectual structure of supply chain management: A bibliometric approach. *Journal of Business Logistics*, *29*(1), 47-73.

Chaudhary, A., Burivalova, Z., Koh, L. P., & Hellweg, S. (2016). Impact of forest management on species richness: global meta-analysis and economic trade-offs. *Scientific reports*, *6*(1), 1-10.

Chen, C. (2013). *Mapping scientific frontiers: The quest for knowledge visualization*. Springer Science & Business Media.

Chen, C. (2014). The citespace manual. *College of Computing and Informatics*, *1*(1), 1-84.

Chen, C. (2017). Science Mapping: A Systematic Review of the Literature [10.1515/jdis-2017-0006]. *Journal of Data and Information Science*, *2*, 1-40.

Chen, C., & Song, M. (2019). Visualizing a field of research: A methodology of systematic scientometric reviews. *PLoS One*, *14*(10), e0223994. https://doi.org/10.1371/journal.pone.0223994

Chen, G. Q., & Han, M. Y. (2015). Global supply chain of arable land use: Production-based and consumption-based trade imbalance [https://doi.org/10.1016/j.landusepol.2015.07.023]. *Land Use Policy*, *49*, 118-130. https://www.sciencedirect.com/science/article/pii/S026483771500232X

Chen, X., Wang, C., & Li, S. (2023). The impact of supply chain finance on corporate social responsibility and creating shared value: a case from the emerging economy. *Supply Chain Management: An International Journal*, *28*(2), 324-346. https://doi.org/10.1108/SCM-10-2021-0478

Chintanapunt, T., & Pichyangkura, R. (2020). Collaborative Cassava-Chip Supply Chain Mobile Application in Thailand.

Christopher, M. (1999). Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service Financial Times: Pitman Publishing. London, 1998 ISBN 0 273 63049 0 (hardback) 294+ 1× pp. In: Taylor & Francis.

Chuaykerd, T., Yao, S., Khamphilavong, S., & Tuyen, H. T. (2020). The Impact Factors of Thai Jasmine Rice Export to International Market. *Open Journal of Business and Management*, *8*(03), 1113.

Croom, S., Romano, P., & Giannakis, M. (2000). Supply chain management: an analytical framework for critical literature review. *European Journal of Purchasing & Supply Management*, *6*(1), 67-83.

Davahli, M. R., Karwowski, W., & Taiar, R. (2020). A system dynamics simulation applied to healthcare: A systematic review. *International Journal of Environmental Research and Public Health*, *17*(16), 5741.

de Hooge, I. E., Oostindjer, M., Aschemann-Witzel, J., Normann, A., Loose, S. M., & Almli, V. L. (2017). This apple is too ugly for me!: Consumer preferences for suboptimal food products in the supermarket and at home. *Food Quality and Preference*, *56*, 80-92. https://doi.org/https://doi.org/10.1016/j.foodqual.2016.09.012

Delgado, J. A., Short, N. M., Roberts, D. P., & Vandenberg, B. (2019). Big Data Analysis for Sustainable Agriculture on a Geospatial Cloud Framework [Review]. *Frontiers in Sustainable Food Systems*, *3*. https://doi.org/10.3389/fsufs.2019.00054

Desai, A., & Rai, S. (2016). Knowledge management for downstream supply chain management of Indian public sector oil companies. *Procedia Computer Science*, *79*, 1021-1028.

Devadason, E. S. (2010). ASEAN–China Trade Flows: moving forward with ACFTA. *Journal of Contemporary China*, *19*(66), 653-674.

Devereux, S., Béné, C., & Hoddinott, J. (2020). Conceptualising COVID-19's impacts on household food security. *Food Security*, *12*(4), 769-772. https://doi.org/10.1007/s12571-020-01085-0

Dias, L. S., & Ierapetritou, M. G. (2017). From process control to supply chain management: An overview of integrated decision making strategies. *Computers & Chemical Engineering*, *106*, 826-835.

Downey, W. D. (1996). The challenge of food and agri products supply chains. Proceedings of the 2nd International Conference on Chain Management in Agri-and Food Business. JH Trienekens, and PJP Zuurbier, eds,

Duncan, E., Rotz, S., Magnan, A., & Bronson, K. (2022). Disciplining land through data: The role of agricultural technologies in farmland assetisation. *Sociologia Ruralis*, *62*(2), 231-249. https://doi.org/https://doi.org/10.1111/soru.12369

Dunning, T. (1994). Accurate methods for the statistics of surprise and coincidence. *Computational linguistics*, *19*(1), 61-74.

Ellram, L. M. (1991). Supply-chain management: the industrial organisation perspective. *International Journal of Physical Distribution & Logistics Management*, *21*(1), 13-22.

Ellram, L. M., & Murfield, M. L. U. (2019). Supply chain management in industrial marketing–Relationships matter. *Industrial Marketing Management*, *79*, 36-45.

Faham, E., Rezvanfar, A., Mohammadi, S. H. M., & Nohooji, M. R. (2017). Using system dynamics to develop education for sustainable development in higher education with the emphasis on the sustainability competencies of students. *Technological Forecasting and Social Change*, *123*, 307-326.

Fan, S., Cho, E. E., Meng, T., & Rue, C. (2021). How to Prevent and Cope with Coincidence of Risks to the Global Food System. *Annual Review of Environment and Resources*, *46*, 601-623.

Fang, D., & Zhang, X. (2021). The protective effect of digital financial inclusion on agricultural supply chain during the COVID-19 pandemic: Evidence from china. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(7), 3202-3217.

Fong, W.-K., Matsumoto, H., & Lun, Y.-F. (2009). Application of System Dynamics model as decision making tool in urban planning process toward stabilizing carbon dioxide emissions from cities. *Building and Environment*, *44*(7), 1528-1537.

Fu, S., Han, Z., & Huo, B. (2017). Relational enablers of information sharing: evidence from Chinese food supply chains. *Industrial Management & Data Systems*.

Fu, S., Wang, Y., Xia, X., & Zheng, J. C. (2020). Exosome engineering: Current progress in cargo loading and targeted delivery. *NanoImpact*, *20*, 100261.

Fuglie, K. O., Wang, S. L., & Ball, V. E. (2012). *Productivity growth in agriculture: an international perspective*. CABI.

Gammelgaard, B. (2004). Schools in logistics research? A methodological framework for analysis of the discipline. *International Journal of Physical Distribution & Logistics Management*.

Gang, Z., Ying-Bao, Y., Xu, B., & Qi-Yuan, P. (2015). On the topological properties of urban complex supply chain network of agricultural products in mainland China. *Transportation Letters*, *7*(4), 188-195. https://doi.org/10.1179/1942787515Y.0000000007

Gao, J., Han, H., Hou, L., & Wang, H. (2016). Pricing and effort decisions in a closed-loop supply chain under different channel power structures. *Journal of Cleaner Production*, *112*, 2043-2057.

Gao, T., Erokhin, V., & Arskiy, A. (2019). Dynamic Optimization of Fuel and Logistics Costs as a Tool in Pursuing Economic Sustainability of a Farm. *Sustainability*, *11*(19), 5463. https://www.mdpi.com/2071-1050/11/19/5463

Garrett, R. D., Levy, S., Carlson, K. M., Gardner, T. A., Godar, J., Clapp, J., Dauvergne, P., Heilmayr, R., le Polain De Waroux, Y., Ayre, B., Barr, R., Døvre, B., Gibbs, H. K., Hall, S., Lake, S., Milder, J. C., Rausch, L. L., Rivero, R., Rueda, X., . . . Villoria, N. (2019). Criteria for effective zero-deforestation commitments [https://doi.org/10.1016/j.gloenvcha.2018.11.003]. *Global Environmental Change*, *54*, 135-147. https://www.sciencedirect.com/science/article/pii/S0959378018306654

Gelsomino, L. M., Mangiaracina, R., Perego, A., & Tumino, A. (2016). Supply chain finance: a literature review. *International Journal of Physical Distribution & Logistics Management*.

Geman, H. (2014). *Agricultural finance: from crops to land, water and infrastructure*. John Wiley & Sons.

Gerassimidou, S., Martin, O. V., Chapman, S. P., Hahladakis, J. N., & Iacovidou, E. (2021). Development of an integrated sustainability matrix to depict challenges and trade-offs of introducing bio-based plastics in the food packaging value chain. *Journal of Cleaner Production*, *286*, 125378. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.125378

Giunipero, L. C., Hooker, R. E., Joseph-Matthews, S., Yoon, T. E., & Brudvig, S. (2008). A decade of SCM literature: past, present and future implications. *Journal of supply chain management*, *44*(4), 66-86.

GÖKKÜR, S., & SINAV, E. (2020). Sustainable Agriculture and New Food Marketing Management System. *Eurasian Journal of Agricultural Research*, *4*(1), 45-55.

Gómez, M. I., Barrett, C. B., Buck, L. E., De Groote, H., Ferris, S., Gao, H. O., McCullough, E., Miller, D. D., Outhred, H., & Pell, A. N. (2011). Research principles for developing country food value chains. *Science*, *332*(6034), 1154-1155.

Grote, U., Fasse, A., Nguyen, T. T., & Erenstein, O. (2021). Food security and the dynamics of wheat and maize value chains in Africa and Asia. *Frontiers in Sustainable Food Systems*, *4*, 617009.

Guan, G., Jiang, Z., Gong, Y., Huang, Z., & Jamalnia, A. (2020). A Bibliometric Review of Two Decades' Research on Closed-Loop Supply Chain: 2001-2020. *IEEE Access*, *9*, 3679-3695.

Gupta, S., & Dutta, K. (2011). Modeling of financial supply chain. *European Journal of Operational Research*, *211*(1), 47-56.

Hajjar, R., Newton, P., Adshead, D., Bogaerts, M., Maguire-Rajpaul, V. A., Pinto, L. F. G., McDermott, C. L., Milder, J. C., Wollenberg, E., & Agrawal, A. (2019). Scaling up sustainability in commodity agriculture: Transferability of governance mechanisms across the coffee and cattle sectors in Brazil. *Journal of Cleaner Production*, *206*, 124-132. https://doi.org/https://doi.org/10.1016/j.jclepro.2018.09.102

Hawkes, C., Friel, S., Lobstein, T., & Lang, T. (2012). Linking agricultural policies with obesity and noncommunicable diseases: A new perspective for a globalising world [https://doi.org/10.1016/j.foodpol.2012.02.011]. *Food Policy*, *37*(3), 343-353. https://www.sciencedirect.com/science/article/pii/S0306919212000152

Helbing, D., Armbruster, D., Mikhailov, A. S., & Lefeber, E. (2006). Information and material flows in complex networks. *Physica A: Statistical Mechanics and its Applications*, *363*(1), xi-xvi. https://doi.org/https://doi.org/10.1016/j.physa.2006.01.042

Henders, S., Persson, U. M., & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities [10.1088/1748-9326/10/12/125012]. *Environmental Research Letters*, *10*(12), 125012. http://dx.doi.org/10.1088/1748-9326/10/12/125012

Hoogwijk, M., Faaij, A., van den Broek, R., Berndes, G., Gielen, D., & Turkenburg, W. (2003). Exploration of the ranges of the global potential of biomass for energy. *Biomass and Bioenergy*, *25*(2), 119-133. https://doi.org/https://doi.org/10.1016/S0961-9534(02)00191-5

Hooy, C.-W., Baharumshah, A. Z., & Brooks, R. D. (2016). The effect of exchange rate volatility on the nexus of technology sophistication and trade fragmentation of ASEAN5 exports to China. *Journal of Asia-pacific business*, *17*(3), 206-228.

Horrigan, L., Lawrence, R. S., & Walker, P. (2002). How sustainable agriculture can address the environmental and human health harms of industrial agriculture. *Environmental Health Perspectives*, *110*(5), 445-456. https://doi.org/doi:10.1289/ehp.02110445

Hosseinzadeh, S., Ketabi, S., Atighehchian, A., & Nazari, R. (2022). Hospital bed capacity management during the COVID-19 outbreak using system dynamics: A case study in Amol public hospitals, Iran. *International Journal of Healthcare Management*, 1-13.

Hua, D. (2004). On the application of supply chain theory in enterprises distributing farm produce. *China Business and Market*, 17-21.

Hulme, P. E., Brundu, G., Carboni, M., Dehnen Schmutz, K., Dullinger, S., Early, R., Essl, F., González Moreno, P., Groom, Q. J., & Kueffer, C. (2018). Integrating invasive species policies across ornamental horticulture supply chains to prevent plant invasions. *Journal of applied ecology*, *55*(1), 92-98.

Jackson, E. L., & Cook, S. (2022). The complex adoption pathways of digital technology in Australian livestock supply chains systems. *Crop and Pasture Science*, -. https://doi.org/https://doi.org/10.1071/CP21593

Jagdambe, S., & Kannan, E. (2020). Effects of ASEAN-India Free Trade Agreement on agricultural trade: The gravity model approach. *World Development Perspectives*, *19*, 100212. https://doi.org/https://doi.org/10.1016/j.wdp.2020.100212

Jifeng, W., Huapu, L., & Hu, P. (2008). System dynamics model of urban transportation system and its application. *Journal of Transportation Systems engineering and information technology*, *8*(3), 83-89.

Jin, H., Li, P., Mao, C., Zhu, K., Chen, H., Gao, Y., & Yu, J. (2020). Pathological complete response after a single dose of anti-PD-1 therapy in combination with chemotherapy as a first-line setting in an unresectable locally advanced gastric cancer with PD-L1 positive and microsatellite instability. *OncoTargets and therapy*, *13*, 1751.

Juma, H., Shaalan, K., & Kamel, I. (2019). A Survey on Using Blockchain in Trade Supply Chain Solutions [10.1109/ACCESS.2019.2960542]. *IEEE Access*, *7*, 184115-184132. file:///D:/Research/物流与供应链20201002/文献读物/按初步分类的文献/贸易/贸易供应链/A Survey on Using Blockchain in Trade Supply Chain Solutions.pdf

Jung, J., Maeda, M., Chang, A., Bhandari, M., Ashapure, A., & Landivar-Bowles, J. (2021). The potential of remote sensing and artificial intelligence as tools to improve the resilience of agriculture production systems. *Current Opinion in Biotechnology*, *70*, 15-22. https://doi.org/https://doi.org/10.1016/j.copbio.2020.09.003

Kain, R., & Verma, A. (2018). Logistics management in supply chain–an overview. *Materials Today: Proceedings*, *5*(2), 3811-3816.

Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2020). Achieving sustainable performance in a data-driven agriculture supply chain: A review for research and applications [10.1016/j.ijpe.2019.05.022]. *International Journal of Production Economics*, *219*(March 2019), 179-194. https://doi.org/10.1016/j.ijpe.2019.05.022file:///D:/Research/物流与供应链20201002/文献读物/按初步分类的文献/农业/农业供应链/Achieving sustainable performance in a data-driven agriculutral supply chain A review for research and application.pdf

Kamika, I., Mngqawa, P., Rheeder, J. P., Teffo, S. L., & Katerere, D. R. (2014). Mycological and aflatoxin contamination of peanuts sold at markets in Kinshasa, Democratic Republic of Congo, and Pretoria, South Africa [10.1080/19393210.2013.858187]. *Food Additives & Contaminants: Part B*, *7*(2), 120-126. https://doi.org/10.1080/19393210.2013.858187

Kaplinsky, R., & Morris, M. (2000). *A handbook for value chain research* (Vol. 113). University of Sussex, Institute of Development Studies Brighton.

Karabulut, A. A., Crenna, E., Sala, S., & Udias, A. (2018). A proposal for integration of the ecosystem-water-food-land-energy (EWFLE) nexus concept into life cycle assessment: A synthesis matrix system for food security [https://doi.org/10.1016/j.jclepro.2017.05.092]. *Journal of Cleaner Production*, *172*, 3874-3889. https://www.sciencedirect.com/science/article/pii/S0959652617310260

Ketchen Jr, D. J., & Hult, G. T. M. (2007). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of operations management*, *25*(2), 573-580.

Khan, I., Hou, F., & Le, H. P. (2021). The impact of natural resources, energy consumption, and population growth on environmental quality: Fresh evidence from the United States of America. *Science of The Total Environment*, *754*, 142222. https://doi.org/https://doi.org/10.1016/j.scitotenv.2020.142222

Khan, S. A. R., Sharif, A., Golpîra, H., & Kumar, A. (2019). A green ideology in Asian emerging economies: From environmental policy and sustainable development. *Sustainable Development*, *27*(6), 1063-1075. https://doi.org/https://doi.org/10.1002/sd.1958

Khan, S. A. R., Yu, Z., Belhadi, A., & Mardani, A. (2020). Investigating the effects of renewable energy on international trade and environmental quality. *Journal of Environmental Management*, *272*, 111089. https://doi.org/https://doi.org/10.1016/j.jenvman.2020.111089

Kittipanya-Ngam, P., & Tan, K. H. (2020). A framework for food supply chain digitalization: lessons from Thailand. *Production Planning & Control*, *31*(2-3), 158-172.

Kovalevsky, D. V. (2016). Modeling Herding Behavior on Financial Markets Affected by Exogenous Climate-Related Shocks.

Kozlenkova, I. V., Hult, G. T. M., Lund, D. J., Mena, J. A., & Kekec, P. (2015). The role of marketing channels in supply chain management. *Journal of Retailing*, *91*(4), 586-609.

Kremen, C., Iles, A., & Bacon, C. (2012). Diversified Farming Systems: An Agroecological, Systems-based Alternative to Modern Industrial Agriculture. *Ecology and Society*, *17*(4), Article 44. https://doi.org/10.5751/ES-05103-170444

Kretschmer, B., Smith, C., Watkins, E., Allen, B., Buckwell, A., Desbarats, J., & Kieve, D. (2013). Recycling Agricultural, Forestry & Food Wastes and Residues for Sustainable Bioenergy and Biomaterials (Part of the Project'Technology Options for Feeding 10 Billion People').

Kunc, M., & Morecroft, J. (2017). System Dynamics Modelling for Business Strategy. *Journal of the Operational Research Society*.

Kuwornu, J. K. (2019). *Climate change and Sub-Saharan Africa: The vulnerability and adaptation of food supply chain actors*. Vernon Press.

Laborde, D., Martin, W., Swinnen, J., & Vos, R. (2020). COVID-19 risks to global food security. *Science*, *369*(6503), 500-502. https://doi.org/doi:10.1126/science.abc4765

Lafargue, P., Rogerson, M., Parry, G. C., & Allainguillaume, J. (2021). Broken chocolate: biomarkers as a method for delivering cocoa supply chain visibility. *Supply Chain Management: An International Journal*.

Lamidi, R. O., Jiang, L., Pathare, P. B., Wang, Y. D., & Roskilly, A. P. (2019). Recent advances in sustainable drying of agricultural produce: A review. *Applied Energy*, *233-234*, 367-385. https://doi.org/https://doi.org/10.1016/j.apenergy.2018.10.044

Lang, J. T. (2013). Elements of public trust in the American food system: Experts, organizations, and genetically modified food. *Food Policy*, *41*, 145-154. https://doi.org/https://doi.org/10.1016/j.foodpol.2013.05.008

Le Port, A., Bernard, T., Hidrobo, M., Birba, O., Rawat, R., & Ruel, M. T. (2017). Delivery of iron-fortified yoghurt, through a dairy value chain program, increases hemoglobin concentration among children 24 to 59 months old in Northern Senegal: A cluster-randomized control trial. *PLoS One*, *12*(2), e0172198.

Leduc, G., Kubler, S., & Georges, J.-P. (2021). Innovative blockchain-based farming marketplace and smart contract performance evaluation [https://doi.org/10.1016/j.jclepro.2021.127055]. *Journal of Cleaner Production*, *306*, 127055. https://www.sciencedirect.com/science/article/pii/S0959652621012749

Lei, L., Yuan, D., Ho, C. K., & Sun, S. (2016). Power and channel allocation for non-orthogonal multiple access in 5G systems: Tractability and computation. *IEEE Transactions on Wireless Communications*, *15*(12), 8580-8594.

Lekkakos, S. D., & Serrano, A. (2016). Supply chain finance for small and medium sized enterprises: the case of reverse factoring. *International Journal of Physical Distribution & Logistics Management*.

Lenzen, M., Moran, D., Kanemoto, K., Foran, B., Lobefaro, L., & Geschke, A. (2012). International trade drives biodiversity threats in developing nations. *Nature*, *486*(7401), 109-112.

Leydesdorff, L., & Vaughan, L. (2006). Co-occurrence matrices and their applications in information science: Extending ACA to the Web environment. *Journal of the American Society for Information Science and technology*, *57*(12), 1616-1628.

Li, B., Zhu, M., Jiang, Y., & Li, Z. (2016). Pricing policies of a competitive dual-channel green supply chain. *Journal of Cleaner Production*, *112*, 2029-2042.

Li, H., Mai, L., Zhang, W., & Tian, X. (2019). Optimizing the credit term decisions in supply chain finance. *Journal of Purchasing and Supply Management*, *25*(2), 146-156.

Li, Y., Chen, B., Li, C., Li, Z., & Chen, G. (2020). Energy perspective of Sino-US trade imbalance in global supply chains [https://doi.org/10.1016/j.eneco.2020.104959]. *Energy Economics*, *92*, 104959. https://www.sciencedirect.com/science/article/pii/S0140988320302991

Li, Y., Wang, W., & Feng, X. (2019). The impacts of financial services on agricultural production supply chain. *Journal of Cleaner Production*, *207*.

Liang, C., Luo, A., & Zhong, Z. (2018). Knowledge mapping of medication literacy study: A visualized analysis using CiteSpace [10.1177/2050312118800199]. *SAGE Open Medicine*, *6*, 2050312118800199. https://doi.org/10.1177/2050312118800199

Liao, H., Tang, M., Luo, L., Li, C., Chiclana, F., & Zeng, X.-J. (2018). A Bibliometric Analysis and Visualization of Medical Big Data Research. *Sustainability*, *10*(1), 166. https://www.mdpi.com/2071-1050/10/1/166

Lin, D., Lee, C., & Lin, K. (2016). Research on effect factors evaluation of internet of things (IOT) adoption in Chinese agricultural supply chain. 2016 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM),

Liñán, J., Arroyo, P., & Carrete, L. (2019). Conceptualizing healthy food: How Consumer's values influence the perceived healthiness of a food product. *J. Food Nutr. Res*, *7*(9), 679-687.

Lioutas, E. D., Charatsari, C., La Rocca, G., & De Rosa, M. (2019). Key questions on the use of big data in farming: An activity theory approach. *NJAS: Wageningen Journal of Life Sciences*, *90-91*(1), 1-12. https://doi.org/10.1016/j.njas.2019.04.003

Liu, J., Herzberger, A., Kapsar, K., Carlson, A. K., & Connor, T. (2019). What Is Telecoupling? In C. Friis & J. Ø. Nielsen (Eds.), *Telecoupling: Exploring Land-Use Change in a Globalised World* (pp. 19-48). Springer International Publishing. https://doi.org/10.1007/978-3-030-11105-2_2

Love, P. E., Irani, Z., & Edwards, D. J. (2004). A seamless supply chain management model for construction. *Supply Chain Management: An International Journal*.

Luo, K., Zhang, X., & Tan, Q. (2018). A Co-Opetition Straw Supply Strategy Integrating Rural Official Organizations and Farmers' Behavior in China. *Energies*, *11*(10), 2802.

Machado Nardi, V. A., Auler, D. P., & Teixeira, R. (2020). Food safety in global supply chains: A literature review [10.1111/1750-3841.14999]. *Journal of Food Science*, *85*(4), 883-891. file:///D:/Research/物流与供应链20201002/文献读物/按初步分类的文献/贸易/贸易供应链/Food safety in global supply chains A literature review..pdf

Malfliet, J. (2011). Incoterms 2010 and the mode of transport: how to choose the right term. Management Challenges in the 21st Century: Transport and Logistics: Opportunity for Slovakia in the Era of Knowledge Economy,

Manfred, K. (2018). Trading Costs in Africa: Does International Supply Chain Connectivity Matter? *Journal of Economic Development*, *43*(2), 85-102.

Mangla, S. K., Kazancoglu, Y., Ekinci, E., Liu, M., Özbiltekin, M., & Sezer, M. D. (2021). Using system dynamics to analyze the societal impacts of blockchain technology in milk supply chainsrefer. *Transportation Research Part E: Logistics and Transportation Review*, *149*, 102289. https://doi.org/https://doi.org/10.1016/j.tre.2021.102289

Manuj, I., & Mentzer, J. T. (2008). GLOBAL SUPPLY CHAIN RISK MANAGEMENT [https://doi.org/10.1002/j.2158-1592.2008.tb00072.x]. *Journal of Business Logistics*, *29*(1), 133-155. https://doi.org/10.1002/j.2158-1592.2008.tb00072.x

Martin, J., & Hofmann, E. (2019). Towards a framework for supply chain finance for the supply side. *Journal of Purchasing and Supply Management*, *25*(2), 157-171.

Martins, C., & Pato, M. (2019). Supply chain sustainability: A tertiary literature review. *Journal of Cleaner Production*, *225*, 995-1016.

Mattias, G., Elena, T., Giuseppe, C., & Anna, F. E. (2021). Modeling the ecosystem service of agricultural residues provision for bioenergy production: A potential application in the Emilia-Romagna region (Italy) [https://doi.org/10.1016/j.ecolmodel.2021.109571]. *Ecological Modelling*, *451*, 109571. https://www.sciencedirect.com/science/article/pii/S0304380021001368

McCAULEY, J. L., & Küffner, C. M. (2004). Economic system dynamics. *Discrete Dynamics in Nature and Society*, *2004*(1), 213-220.

Meixell, M. J., & Gargeya, V. B. (2005). Global supply chain design: A literature review and critique [https://doi.org/10.1016/j.tre.2005.06.003]. *Transportation Research Part E: Logistics and Transportation Review*, *41*(6), 531-550. https://www.sciencedirect.com/science/article/pii/S1366554505000487

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, *22*(2), 1-25.

Min, S., Zacharia, Z. G., & Smith, C. D. (2019). Defining supply chain management: in the past, present, and future. *Journal of Business Logistics*, *40*(1), 44-55.

Miret, C., Chazara, P., Montastruc, L., Negny, S., & Domenech, S. (2016). Design of bioethanol green supply chain: Comparison between first and second generation biomass concerning economic, environmental and social criteria [https://doi.org/10.1016/j.compchemeng.2015.10.008]. *Computers & Chemical Engineering*, *85*, 16-35. https://www.sciencedirect.com/science/article/pii/S0098135415003233

Mittal, S., & Sethi, M. (2018). Smart and livable cities: Opportunities to enhance quality of life and realize multiple co-benefits. *Mainstreaming climate co-benefits in Indian cities: Post-habitat III innovations and reforms*, 245-263.

Mohammadi, A., & Pashootanizadeh, H. (2017). Scenario Planning the Effect of Foreign Gold Price and Exchange Rate on Financial market with Using System Dynamics approach. *Journal of Financial Management Perspective*, *7*(19), 27-50.

Moretto, A., Grassi, L., Caniato, F., Giorgino, M., & Ronchi, S. (2019). Supply chain finance: From traditional to supply chain credit rating. *Journal of Purchasing and Supply Management*, *25*(2), 197-217.

Mou, J., Cui, Y., & Kurcz, K. (2019). Bibliometric and visualized analysis of research on major e-commerce journals using citespace. *Journal of Electronic Commerce Research*, *20*(4), 219-237. file:///D:/Research/物流与供应链20201002/文献读物/CiteSpace/Bibliometric and Visuablized Analysis of Research on Major E Commerce Journals Using CiteSpace.pdf

Mr, H. S. J., & Mr, S. S. K. (2016). Integration of spark framework in supply chain management. *Procedia Computer Science*, *79*, 1013-1020.

Muganyi, T., & Chen, H. (2016). Strategic economic partnerships, exchange rate policy and agricultural trade: A gravity model analysis of China's agricultural trade flows. *Open Journal of Social Sciences*, *4*(5), 48-55.

Muralikrishna, I. V., & Manickam, V. (2017). Chapter Five - Life Cycle Assessment. In I. V. Muralikrishna & V. Manickam (Eds.), *Environmental Management* (pp. 57-75). Butterworth-Heinemann. https://www.sciencedirect.com/science/article/pii/B9780128119891000051

Mutsonziwa, K., Schicks, J., & Guérin, I. (2021). Innovative fintechs in agriculture. *Journal of Financial Services*.

Mwangi, H. N. (2016). *A within host system dynamics model of Hiv/Aids, tuberculosis and malaria treatment policy* University of Nairobi].

Nakamura, S., Iida, A., Nakatani, J., Shimizu, T., Ono, Y., Watanabe, S., Noda, K., & Kitalong, C. (2021). Global land use of diets in a small island community: a case study of Palau in the Pacific [10.1088/1748-9326/ac0212]. *Environmental Research Letters*, *16*(6), 065016. http://dx.doi.org/10.1088/1748-9326/ac0212

Nayal, K., Raut, R., Lopes de Sousa Jabbour, A. B., Narkhede, B. E., & Gedam, V. V. (2021). Integrated technologies toward sustainable agriculture supply chains: missing links. *Journal of Enterprise Information Management*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/JEIM-09-2020-0381

Nettle, R., Klerkx, L., Faure, G., & Koutsouris, A. (2017). Governance dynamics and the quest for coordination in pluralistic agricultural advisory systems. *The Journal of Agricultural Education and Extension*, *23*(3), 189-195. https://doi.org/10.1080/1389224X.2017.1320638

Nidhiprabha, B. (2019). Impacts of the US–China trade war on ASEAN: Case of Thailand. *Asian Economic Papers*, *18*(3), 166-188.

Niles, M. T., Bertmann, F., Belarmino, E. H., Wentworth, T., Biehl, E., & Neff, R. (2020). The Early Food Insecurity Impacts of COVID-19. *Nutrients*, *12*(7), 2096. https://www.mdpi.com/2072-6643/12/7/2096

Nooraie, S. V., & Parast, M. M. (2016). Mitigating supply chain disruptions through the assessment of trade-offs among risks, costs and investments in capabilities. *International Journal of Production Economics*, *171*, 8-21.

Nyström, M., Jouffray, J. B., Norström, A. V., Crona, B., Søgaard Jørgensen, P., Carpenter, S. R., Bodin, Ö., Galaz, V., & Folke, C. (2019). Anatomy and resilience of the global production ecosystem [10.1038/s41586-019-1712-3]. *Nature*, *575*(7781), 98-108. https://doi.org/10.1038/s41586-019-1712-3

O'Neill, B. C., Carter, T. R., Ebi, K., Harrison, P. A., Kemp-Benedict, E., Kok, K., Kriegler, E., Preston, B. L., Riahi, K., Sillmann, J., van Ruijven, B. J., van Vuuren, D., Carlisle, D., Conde, C., Fuglestvedt, J., Green, C., Hasegawa, T., Leininger, J., Monteith, S., & Pichs-Madruga, R. (2020). Achievements and needs for the climate change scenario framework. *Nature Climate Change*, *10*(12), 1074-1084. https://doi.org/10.1038/s41558-020-00952-0

Oelze, N., Brandenburg, M., Jansen, C., & Warasthe, R. (2018). Applying sustainable supply chain management frameworks to two german case studies. *IFAC-PapersOnLine*, *51*(30), 293-296.

Olabisi, L. S., Azhar, G. S., Abbott, M., & Lempert, R. J. (2018). Participatory Modeling of Climate Change Impacts on Public Health in Long Beach, California: Discussion from a Workshop Hosted by the RAND Frederick S. Pardee Center for Longer Range Global Policy and the Future Human Condition. *Rand Health Quarterly*, *8*(1).

Onyusheva, I., Khamboocha, R., & Muangmutcha, N. (2020). THE US-CHINA TRADE WAR AND ITS IMPACT ON THAILAND'S ECONOMY. *The EUrASEANs: journal on global socio-economic dynamics*(2 (21)), 17-32.

Pan, K., Cui, Z., Xing, A., & Lu, Q. (2020). Impact of fairness concern on retailer-dominated supply chain. *Computers & Industrial Engineering*, *139*, 106209.

Pant, L. P., Odame, H. H., & Hambly-Odame, H. (2022). System dynamics and innovation in agricultural finance. *Agricultural Finance Review*.

Pellegrino, R., Costantino, N., & Tauro, D. (2019). Supply Chain Finance: A supply chain-oriented perspective to mitigate commodity risk and pricing volatility. *Journal of Purchasing and Supply Management*, *25*(2), 118-133.

Pham, T. S. H., Darabi, F., & Wilmot, N. V. (2020). International supply chain case study. In *Supply Chain and Logistics Management: Concepts, Methodologies, Tools, and Applications* (pp. 1183-1204). IGI Global.

Prasertwattanakul, Y., & Ongkunaruk, P. (2018). The analysis of a vertically integrated organic rice company: a case study in Thailand. *International Food Research Journal*, *25*(2), 481-486.

Prater, E., Biehl, M., & Smith, M. A. (2001). International supply chain agility-Tradeoffs between flexibility and uncertainty. *International journal of operations & production management*, *21*(5/6), 823-839.

Prompatanapak, A., & Lopetcharat, K. (2020). Managing changes and risk in seafood supply chain: A case study from Thailand. *Aquaculture*, *525*, 735318.

Punyaratabandhu, P., & Swaspitchayaskun, J. (2018). The political economy of China–Thailand development under the one belt one road initiative: Challenges and opportunities. *The Chinese Economy*, *51*(4), 333-341.

Rasul, G. (2021). A framework for addressing the twin challenges of COVID-19 and climate change for sustainable agriculture and food security in South Asia. *Front. Sustain. Food Syst. 5: 679037. doi: 10.3389/fsufs*.

Rattana-amornpirom, O. (2020). The impacts of ACFTA on export of Thai agricultural products to China. *Journal of ASEAN PLUS Studies*, *1*(1), 44-54.

Reardon, T., Timmer, C. P., & Minten, B. (2012). Supermarket revolution in Asia and emerging development strategies to include small farmers. *Proceedings of the National Academy of Sciences*, *109*(31), 12332-12337.

Ren, C. H. (2017). The Characteristics of Systems Formation. In C. H. Ren (Ed.), *How Systems Form and How Systems Break: A Beginner's Guide for Studying the World* (pp. 7-101). Springer International Publishing. https://doi.org/10.1007/978-3-319-44030-9_2

Rich, K. M., Pg, C., Muniyappa, A., Yadava, C. G., Manjyapura, G. S., Pradeepa Babu, B. N., Shubha, Y. C., & Rich, M. (2018). Coffee certification in India: Awareness, practices, and sustainability perception of growers. *Agroecology and Sustainable Food Systems*, *42*(4), 448-474.

Rode, M., & de Viteri, A. S. (2018). Expressive attitudes to compensation: The case of globalization. *European Journal of Political Economy*, *54*, 42-55.

Rohm, H., Oostindjer, M., Aschemann-Witzel, J., Symmank, C., L. Almli, V., De Hooge, I. E., Normann, A., & Karantininis, K. (2017). Consumers in a Sustainable Food Supply Chain (COSUS): Understanding Consumer Behavior to Encourage Food Waste Reduction. *Foods*, *6*(12), 104. https://www.mdpi.com/2304-8158/6/12/104

Sánchez-Bravo, P., Chambers V, E., Noguera-Artiaga, L., Sendra, E., Chambers Iv, E., & Carbonell-Barrachina, Á. A. (2021). Consumer understanding of sustainability concept in agricultural products. *Food Quality and Preference*, *89*, 104136. https://doi.org/https://doi.org/10.1016/j.foodqual.2020.104136

Sathapatyanon, J., Kuwornu, J. K., Shivakoti, G. P., Soni, P., Anal, A. K., & Datta, A. (2018). The role of farmer organizations and networks in the rice supply chain in Thailand. *Journal of Agribusiness in Developing and Emerging Economies*.

Shepherd, S. (2014). A review of system dynamics models applied in transportation. *Transportmetrica B: Transport Dynamics*, *2*(2), 83-105.

Sinha, D., Bagodi, V., & Dey, D. (2020). The supply chain disruption framework post COVID-19: A system dynamics model. *Foreign trade review*, *55*(4), 511-534.

Stadtler, H. (2008). Supply chain management—an overview. *Supply chain management and advanced planning*, 9-36.

Stank, T. P., Esper, T. L., Crook, T. R., & Autry, C. W. (2012). Creating relevant value through demand and supply integration. *Journal of Business Logistics*, *33*(2), 167-172.

Stojanović, Đ., & Ivetić, J. (2020). Possibilities of using Incoterms clauses in a country logistics performance assessment and benchmarking. *Transport Policy*, *98*, 217-228.

Sugirin, M. (2009). Financial supply chain management. *Journal of Corporate Treasury Management*, *2*(3).

Sun, L., Xu, X., Yang, Y., Liu, W., & Jin, J. (2020). Knowledge mapping of supply chain risk research based on CiteSpace [10.1111/coin.12306]. *Computational Intelligence*, *36*(4), 1686-1703. file:///D:/Research/物流与供应链20201002/文献读物/CiteSpace/Knowledge mapping ofsupply chain risk research based on CiteSpace.pdf

Svensson, G. (2004). Key areas, causes and contingency planning of corporate vulnerability in supply chains: A qualitative approach. *International Journal of Physical Distribution & Logistics Management*.

Tan, B., Yan, J., Chen, S., & Liu, X. (2018). The impact of blockchain on food supply chain: The case of walmart. Smart Blockchain: First International Conference, SmartBlock 2018, Tokyo, Japan, December 10–12, 2018, Proceedings 1,

Tan, K. C. (2001). A framework of supply chain management literature. *European Journal of Purchasing & Supply Management*, *7*(1), 39-48.

Tantrakoonsab, N., & Tantrakoonsab, W. (2021). Thai exports of durian to China: the expanding role of Chinese entrepreneurs. In *Global Production Networks and Rural Development* (pp. 82-105). Edward Elgar Publishing.

Tian, F. (2016). An agri-food supply chain traceability system for China based on RFID & blockchain technology. 2016 13th international conference on service systems and service management (ICSSSM),

Tian, W., Wu, X., Zhao, X., Ma, R., & Zhang, B. (2019). Quantifying global CH4 and N2O footprints [https://doi.org/10.1016/j.jenvman.2019.109566]. *Journal of Environmental Management*, *251*, 109566. https://www.sciencedirect.com/science/article/pii/S0301479719312848

Tickner, D., Opperman, J. J., Abell, R., Acreman, M., Arthington, A. H., Bunn, S. E., Cooke, S. J., Dalton, J., Darwall, W., Edwards, G., Harrison, I., Hughes, K., Jones, T., Leclère, D., Lynch, A. J., Leonard, P., McClain, M. E., Muruven, D., Olden, J. D., . . . Young, L. (2020). Bending the Curve of Global Freshwater Biodiversity Loss: An Emergency Recovery Plan. *BioScience*, *70*(4), 330-342. https://doi.org/10.1093/biosci/biaa002

Tröger, K., Lelea, M. A., Hensel, O., & Kaufmann, B. (2020). Re-framing post-harvest losses through a situated analysis of the pineapple value chain in Uganda [https://doi.org/10.1016/j.geoforum.2020.02.017]. *Geoforum*, *111*, 48-61. https://www.sciencedirect.com/science/article/pii/S001671852030052X

Turner, B. L., Menendez III, H. M., Gates, R., Tedeschi, L. O., & Atzori, A. S. (2016). System dynamics modeling for agricultural and natural resource management issues: Review of some past cases and forecasting future roles. *Resources*, *5*(4), 40.

Uwizeye, A., de Boer, I. J. M., Opio, C. I., Schulte, R. P. O., Falcucci, A., Tempio, G., Teillard, F., Casu, F., Rulli, M., & Galloway, J. N. (2020). Nitrogen emissions along global livestock supply chains. *Nature Food*, *1*(7), 437-446.

Van Bergen, M., Steeman, M., Reindorp, M., & Gelsomino, L. (2019). Supply chain finance schemes in the procurement of agricultural products. *Journal of Purchasing and Supply Management*, *25*(2), 172-184.

Van Hoyweghen, K., Fabry, A., Feyaerts, H., Wade, I., & Maertens, M. (2021). Resilience of global and local value chains to the Covid-19 pandemic: Survey evidence from vegetable value chains in Senegal [https://doi.org/10.1111/agec.12627]. *Agricultural Economics*, *52*(3), 423-440. https://doi.org/10.1111/agec.12627

Vanham, D., Leip, A., Galli, A., Kastner, T., Bruckner, M., Uwizeye, A., van Dijk, K., Ercin, E., Dalin, C., Brandão, M., Bastianoni, S., Fang, K., Leach, A., Chapagain, A., Van der Velde, M., Sala, S., Pant, R., Mancini, L., Monforti-Ferrario, F., . . . Hoekstra, A. Y. (2019). Environmental footprint family to address local to planetary sustainability and deliver on the SDGs [https://doi.org/10.1016/j.scitotenv.2019.133642]. *Science of The Total Environment*, *693*, 133642. https://www.sciencedirect.com/science/article/pii/S0048969719335673

Vroegindewey, R., & Hodbod, J. (2018). Resilience of Agricultural Value Chains in Developing Country Contexts: A Framework and Assessment Approach. In (Vol. 10).

Vyas, S., Chanana, N., Chanana, M., & Aggarwal, P. K. (2021). From Farm to Fork: Early Impacts of COVID-19 on Food Supply Chain. *Front. Sustain. Food Syst*, *5*, 15.

W, L., X, H., H, F., V, W., Y, H., J, W., H, Y., D, Y., & L, Y. (2020). Blockchain Technology in Current Agricultural Systems: From Techniques to Applications [10.1109/ACCESS.2020.3014522]. *IEEE Access*, *8*, 143920-143937.

Wallace, J. M., & Gutzler, D. S. (1981). Teleconnections in the geopotential height field during the Northern Hemisphere winter. *Monthly weather review*, *109*(4), 784-812.

Wattanutchariya, W., Tansuchat, R., & Ruennareenard, J. (2016). Supply chain management of Thai parboiled rice for export. International Conference on Industrial Engineering and Operations Management,

Weinzettel, J., Vačkářů, D., & Medková, H. (2019). Potential net primary production footprint of agriculture: A global trade analysis [https://doi.org/10.1111/jiec.12850]. *Journal of Industrial Ecology*, *23*(5), 1133-1142. https://doi.org/10.1111/jiec.12850

Welfle, A., Gilbert, P., & Thornley, P. (2014). Securing a bioenergy future without imports. *Energy Policy*, *68*, 1-14. https://doi.org/https://doi.org/10.1016/j.enpol.2013.11.079

Whalley, J., & Wang, L. (2011). The impacts of Renminbi appreciation on trade flows and reserve accumulation in a monetary trade model. *Economic Modelling*, *28*(1-2), 614-621.

Wieland, A., & Wallenburg, C. M. (2011). *Supply-chain-management in stürmischen Zeiten*. Univ.-Verlag der TU.

Win, H. (2017). Analysis of tropical fruits in Thailand. *FFTC Agricultural Policy Article. Food and Fertilizer Technology Center for the Asia Pacific Region: Taipei*.

World, B. (2014). South Asia. In.

Wu, D., Chen, J., Li, P., & Zhang, R. (2020). Contract coordination of dual channel reverse supply chain considering service level. *Journal of Cleaner Production*, *260*, 121071.

Wu, X. D., Guo, J. L., Han, M. Y., & Chen, G. Q. (2018). An overview of arable land use for the world economy: From source to sink via the global supply chain [https://doi.org/10.1016/j.landusepol.2018.05.005]. *Land Use Policy*, *76*, 201-214. https://www.sciencedirect.com/science/article/pii/S0264837718303168

Wysocki, A. F. (2000). Supply chain management: past and future. *Journal of Food Distribution Research*, *31*(856-2016-56383), 53-55.

Xu, Y., Li, Y., & Zhang, M. (2020). Modelling the green agricultural supply chain: a system dynamics approach. *International Journal of Simulation and Process Modelling*.

Xu, Z., Li, Y., Chau, S. N., Dietz, T., Li, C., Wan, L., Zhang, J., Zhang, L., Li, Y., Chung, M. G., & Liu, J. (2020). Impacts of international trade on global sustainable development. *Nature Sustainability*, *3*(11), 964-971. https://doi.org/10.1038/s41893-020-0572-z

Yadav, S., Luthra, S., & Garg, D. (2021). Modelling Internet of things (IoT)-driven global sustainability in multi-tier agri-food supply chain under natural epidemic outbreaks. *Environmental Science and Pollution Research*, *28*(13), 16633-16654. https://doi.org/10.1007/s11356-020-11676-1

Yang, C., Zeng, W., & Yang, X. (2020). Coupling coordination evaluation and sustainable development pattern of geo-ecological environment and urbanization in Chongqing municipality, China. *Sustainable Cities and Society*, *61*, 102271. https://doi.org/https://doi.org/10.1016/j.scs.2020.102271

Ye, Q., Wang, B., & Mao, J. (2020). The pathogenesis and treatment of theCytokine Storm'in COVID-19. *Journal of infection*, *80*(6), 607-613.

Yu, L. (2006). Understanding information inequality: Making sense of the literature of the information and digital divides. *Journal of Librarianship and Information Science*, *38*(4), 229-252.

Yu, Y., Feng, K., & Hubacek, K. (2013). Tele-connecting local consumption to global land use [https://doi.org/10.1016/j.gloenvcha.2013.04.006]. *Global Environmental Change*, *23*(5), 1178-1186. https://www.sciencedirect.com/science/article/pii/S0959378013000721

Yu, Y., Wang, X., Zhong, R. Y., & Huang, G. Q. (2016). E-commerce logistics in supply chain management: Practice perspective. *Procedia Cirp*, *52*, 179-185.

Zeng, Z., & Hengsadeekul, T. (2020). Environmental issues and social responsibility: A scientomeric analysis using citespace. *Entrepreneurship and Sustainability Issues*, *8*(2), 1419.

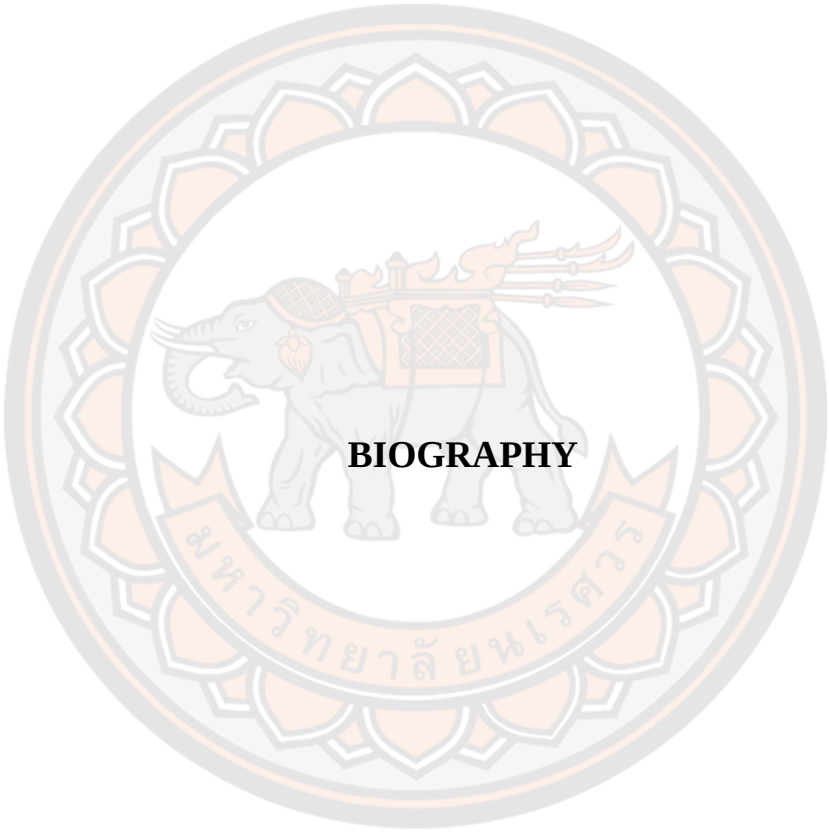
Zeng, Z., Shen, Y., Hengsadeekul, T., & Yang, J. (2021). Web of science based visual knowledge mapping analysis of synergy development of environment and society. *Annals of Operations Research*, 1-20.

Zhang, X., & Aramyan, L. H. (2009). A conceptual framework for supply chain governance. *China Agricultural Economic Review*, *1*(2), 136-154. https://doi.org/10.1108/17561370910927408

Zhu, Y., Xie, C., Sun, B., Wang, G.-J., & Yan, X.-G. (2016). Predicting China's SME credit risk in supply chain financing by logistic regression, artificial neural network and hybrid models. *Sustainability*, *8*(5), 433.

Zilberman, D., Schmitz, A., Casterline, G., Lichtenberg, E., & Siebert, J. B. (1991). The economics of pesticide use and regulation. *Science*, *253*(5019), 518-522.

Zkik, K., Belhadi, A., Rehman Khan, S. A., Kamble, S. S., Oudani, M., & Touriki, F. E. (2022). Exploration of barriers and enablers of blockchain adoption for sustainable performance: implications for e-enabled agriculture supply chains. *International Journal of Logistics Research and Applications*, 1-38. https://doi.org/10.1080/13675567.2022.2088707



BIOGRAPHY

BIOGRAPHY

Name-Surname	Yongtao Shen
Date of Birth	23 June 1989
Address	2-2-605, Hong Ri Xue Fu, Lu Ban Road, Xixiangtang District, Nanning City, Guangxi Zhuang Autonomous Region, China
Current Workplace	No.189 Western Daxue Road, Xixiangtang District, Nanning City, Guangxi Zhuang Autonomous Region, China