FPT Education

FPT UNIVERSITY

GRADUATION THESIS

CRITICAL FACTORS TOWARDS IMPLEMENTING SUSTAINABLE LAST-MILE DELIVERY OF URBAN E-COMMERCE LOGISTICS IN VIETNAM - EXPERT PERSPECTIVES

Group code: GFA23BIZ05
Topic code: FA23BIZ04

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CONTENT OUTLINE

01 INTRODUCTION

02 LITERATURE REVIEW

03 METHODOLOGY

04 FINDINGS AND ANALYSES

05 CONCLUSIONS AND IMPLICATIONS

01. INTRODUCTION

1.3

Topic Background

❉ Development of E-commerce in Vietnam

- Known as electronic commerce or internet commerce means buying and selling goods and services over the internet
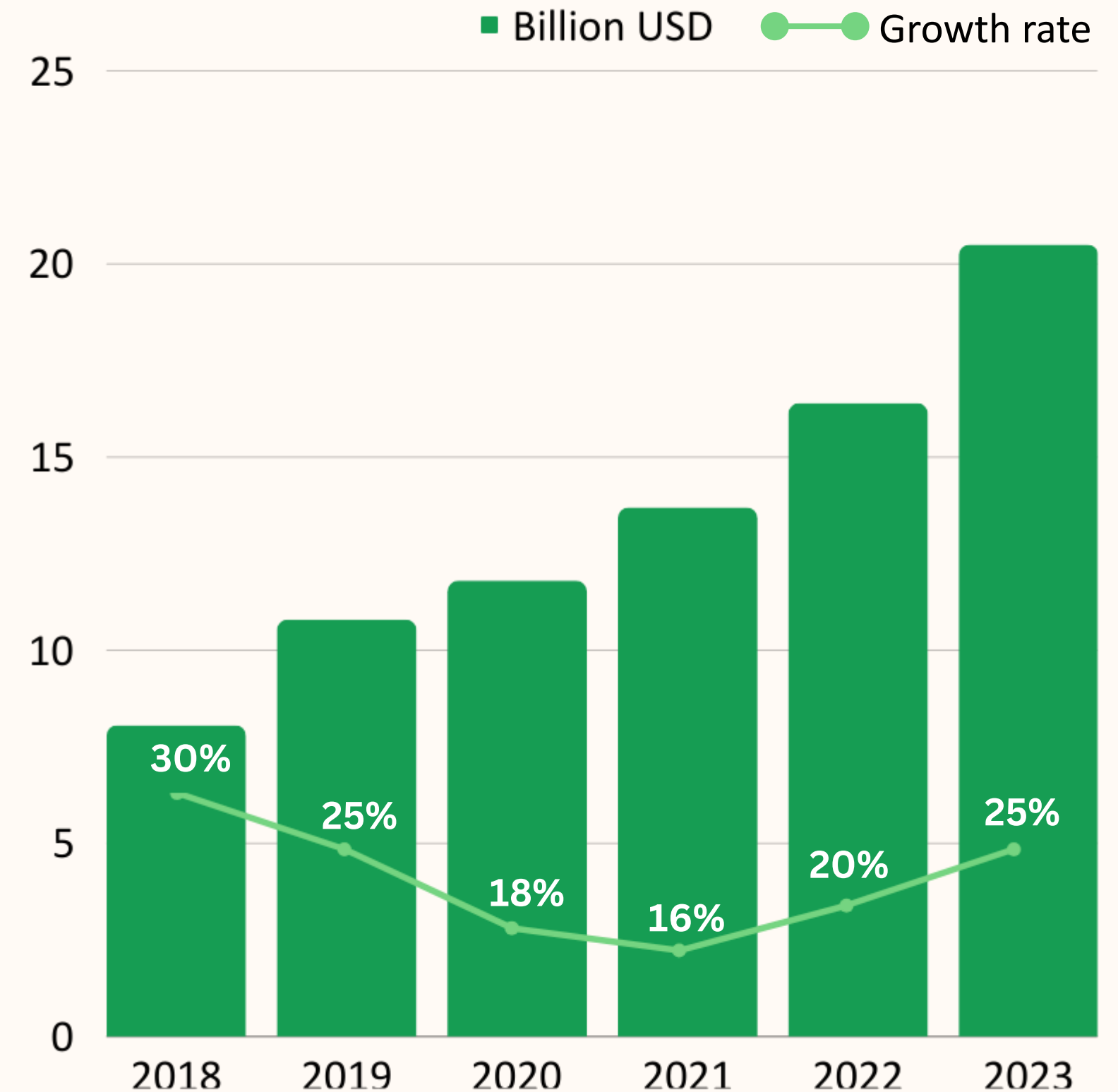
    (Aggarwal and Anchal, 2023)

- Facilitate business activities, provides many new values and meets the new requirements of businesses and consumers

    (Tsagkias et al., 2021)

- Top 5 countries with the world's leading growth rates, accounting for more than 60% of the value of the economy.

    (Vietnam's Ministry of Finance, 2023)

■ Billion USD ●—● Growth rate

Figure 1.1 *Vietnam B2C e-commerce revenue in 2018 - 2023*

(Source: Vietnam's Ministry of Industry and Commerce)

Topic Background

❋ Urbanization in Vietnam

- Regarded as a population transformation from small agricultural rural settlements to densely bigger urban settlements where industrial and service activities are the dominant economic activity.

  (The United Nations, 2015)

- Creating favorable conditions for socio-economic development, promoting economic and labor restructuring towards industrialization and modernization.

  (Vietnam's Ministry of Construction, 2022)

- Large urban areas contribute about 70% of the country's GDP while accounting for 2.9% in area and 22% in population.

  (Vietnam's Ministry of Construction, 2022)
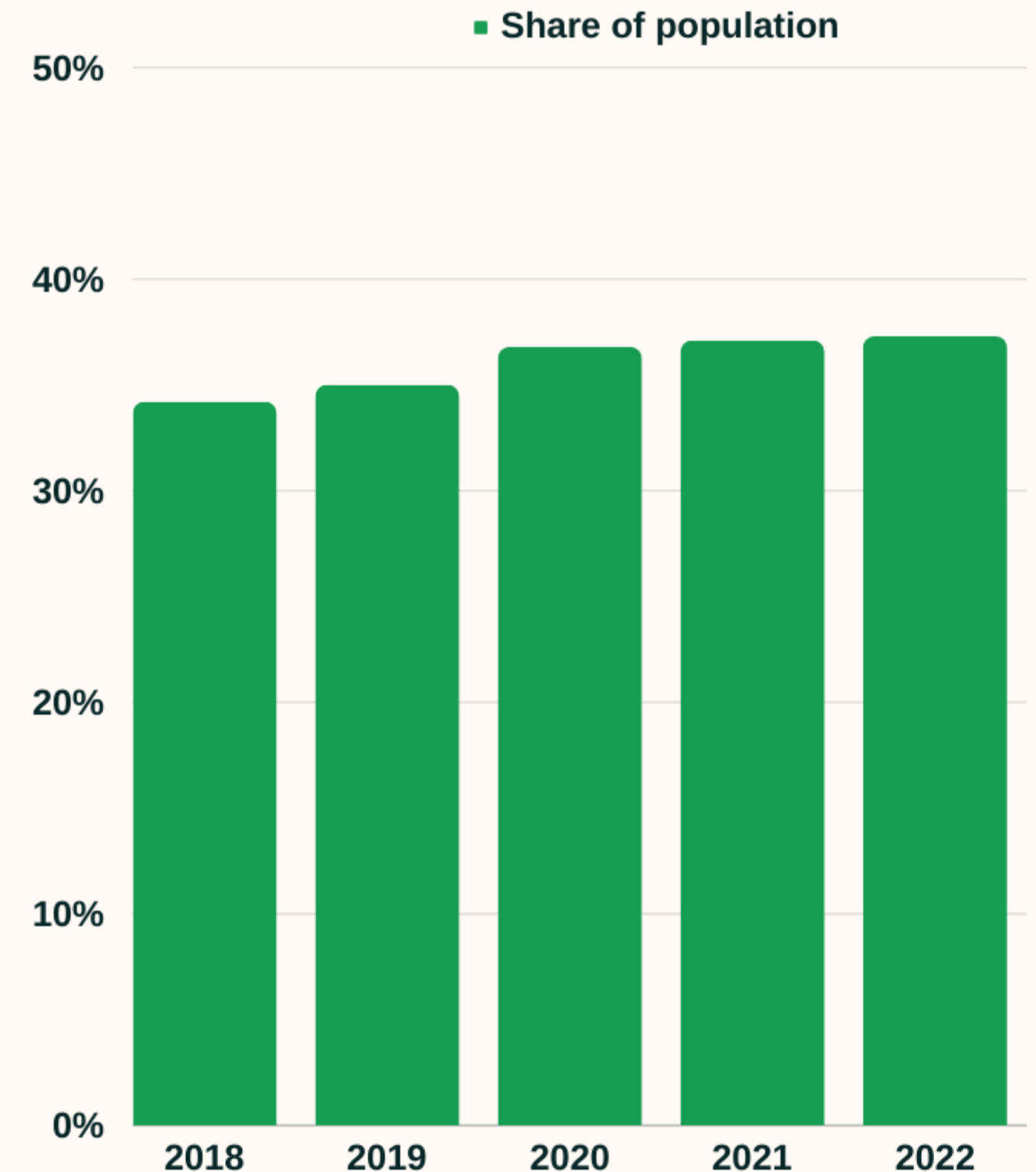
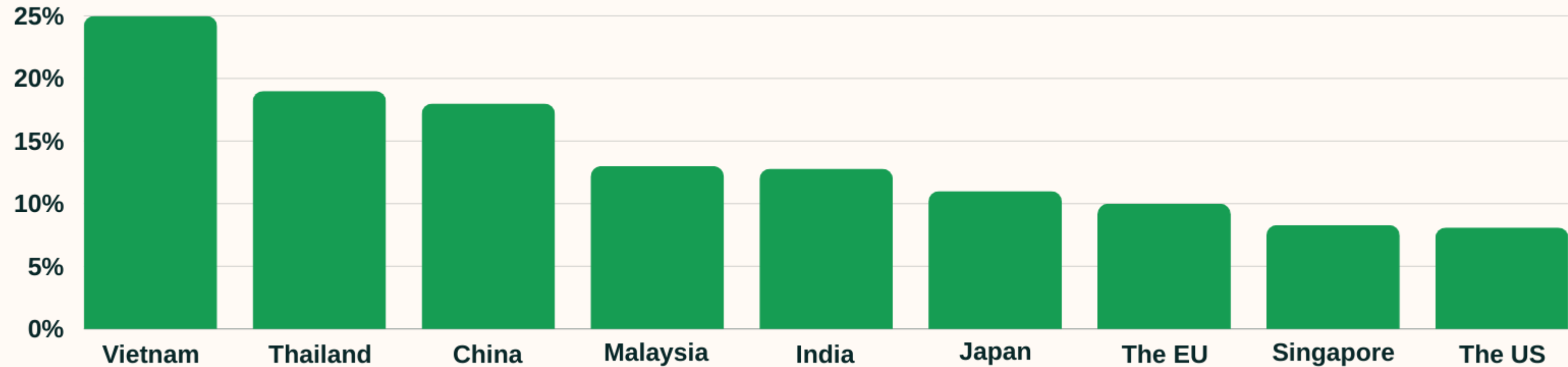*Figure 1.2* *Share of the urban population in Vietnam from 2018 to 2022 (Source: Statista)*

Topic Background

Figure 1.3 *Logistics cost as percentage of GDP (Source: The World Bank 2018)*

❋ Vietnam Logistics industry

- Major contributions to Vietnam's economic landscape with a 14-16% annual growth rate

  (Vietnam's Ministry of Finance, 2023)

- Placed 10th among 50 rising logistics markets worldwide

  (Agility Ranking 2023)

❋ Last-mile delivery (LMD)

- A critical phase of logistics - final step of order fulfillment.

  (Van Duin et al. 2019)

- The most expensive logistics activity and the least efficient stage in the supply chain

  (Song et al., 2016; Ranieri et al., 2018)

Problem Statement

❄ Theoretical Problem

- Few Vietnamese articles about sustainable logistics, especially last-mile delivery service.

- Mainly from the customer viewpoint: service quality, customer satisfaction, and customer experience.

- Rarely mention other important aspects of sustainability.

❄ Practical Problem

- Negative impact on the environment

- High logistics costs

- Poor technological infrastructure

- The growing importance of urban areas for economic development compared to rural areas.

What are the trends in the development of E-commerce LMD in urban Vietnam?

01

Clarifying the development trends of urban E-commerce LMD.

What are the most important factors affecting sustainability in urban E-commerce LMD?

02

Present a conceptual framework including a set of 21 sub-criteria with priority ranking for LMD companies to evaluate their sustainable performance.

How can LMD providers in Vietnam improve their services and grow sustainably?

03

Provide valuable recommendations for LMD companies to improve their services and grow sustainably.

- Location: Vietnam urban area

- Time: August 2023 - October 2023

- Type of survey: direct questionnaire

- Characteristics:

-Specializing in Vietnam's logistics industry

- Over five years of working experience

- Research experience

- Professional qualifications

- Analytic Hierarchy Process (AHP): determines the weights of the criteria and evaluates the impact of the criteria on the sustainability of last-mile delivery service.

- Quantitative method

- Qualitative method
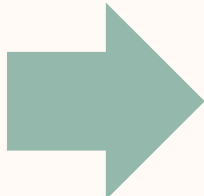
- Primary data

- Secondary data

02. LITERATURE REVIEW

Theory of Service Quality and Triple-Bottom-Line

Service Quality

In the qualitative research technique of Arabelen and Kaya (2021), Logistics Service Quality (LSQ) has been becoming a more important aspect for Logistics service providers (LSPs) and logistics service customers of the increased universality of logistics services' importance.

The Triple Bottom Line (TBL)

The Triple Bottom Line (TBL), a well-known sustainable concept, examines the link between economics, the environment, and social performance (Norman & Macdonald, 2004).

For combining LSQ dimensions with TBL sustainability dimensions can lead to significant benefits for logistics providers (An et al., 2021).

Those approaches can help businesses and policymakers develop sustainable logistics systems in general and last-mile logistics in particular.

Proposed Factors

Main Criteria	Sub Criteria
M1. Service Convenience	S1. Convenience Of Payment
	S2. Convenience Of Setting The Parcel Receiving Time
	S3. Convenience Of Delivery Location
	S4. Convenience Of Returning Goods
M2. Service Responsiveness	S5. Timeliness Of Customer Service Response
	S6. Timeliness Of Goods Delivery
M3. Service Reliability	S7. Integrity Of Goods
	S8. Accuracy Of Goods Arrival
	S9. Accuracy Of Logistics Information

Main Criteria	Sub Criteria
M4. Economic Aspect	S10. Costs
	S11. Technology Capability
	S12. Urban Distribution System
M5. Environmental Aspect	S13. Green Vehicle
	S14. Green Packaging
	S15. Green Warehouse
	S16. Green Management Systems
M6. Social Aspect	S17. Health And Safety
	S18. Government Regulations
	S19. Customer Satisfaction
	S20. Employee Satisfaction
	S21. Cooperation Among Stakeholders To Adapt Change In Customer Behavior

Proposed Factors

- **[M1] Service Convenience**
  - Definition: A convenience service is the quality of being useful, easy, or suitable for online browsing, ordering, payment, and customer service (Jiang et al., 2019).
  - Service convenience, including convenience in receiving and returning goods, is a top priority in customers' attitudes and beliefs toward last-mile delivery services, driving purchase demand (Zarei et al., 2020).

	Sub-criteria	Definition	Reference
[M1] Service Convenience	[S01] Convenience of Payment	Delivery service providers to offer a diverse range of payment options	Wang et al., 2021
	[S02] Convenience of setting the parcel receiving time	The capacity of delivery services to offer consumers the option to choose from a range of predetermined time windows.	Manerba et al., 2018
	[S03] Convenience of delivery location	A delivery service's capacity to offer a range of delivery locations so that consumers can select where their orders are delivered	Lim et al., 2018
	[S04] Convenience of returning goods	Logistics businesses have customer-friendly return policies and procedures, which ensure ease, flexibility, and the option to select from a variety of return options	Wodnicka & Skurpel, 2021

Proposed Factors

- **[M2] Service Responsiveness**
  - Definition: Refers to the timeliness of customer service in responding to customer questions and requests, and the speed of delivery processing to meet customer expectations (Jiang et al., 2019).
  - An important criterion for evaluating the service quality of e-commerce and logistics companies.

	Sub-criteria	Definition	Reference
[M2] Service Responsiveness	Timeliness of customer service response (S05)	Replies to customers' questions, delivery, return, and replacement processing speed, etc. E-commerce and logistics companies are expected to respond to and deal with these problems promptly.	Dung et al., 2023
	Timeliness of goods delivery (S06)	Refers to the degree of adherence to predetermined schedules or customer expectations in the transportation and receipt of ordered products	Li et al., 2006

Proposed Factors

- **[M3] Service Reliability**
  - Definition: Refers to the completeness, integrity, and accuracy of goods, while also considering the accuracy of information and time of shipment (Uzir et al., 2021).
  - The quality of shipping and delivery services is confirmed in importance by 30% of surveyed customers when purchasing online (Department of E-commerce and Digital Economy, 2022).

	Sub-criteria	Definition	Reference
[M3] Service Reliability	Integrity of goods (S07)	Condition of the good arrivals that are undamaged or accepted for unwanted issues by implementing replacement procedures in the professional workforce	Restuputri, Fridawati and Masudin, 2022
	Accuracy of goods arrival (S08)	Logistics system pick up and ship the right goods according to orders.	Chen et al., 2023
	Accuracy of logistics information (S19)	Refers to the degree of precision and correctness exhibited by data associated with various facets of supply chain operations	Iveta et al., 2014

Proposed Factors

- **[M4] Economic Aspect**
  - Definition: Refers to the contribution to the micro level of the economy such as selling price, costs, and revenue of products of the company; and contributes on the macro level of the economy which is economic profit through economic growth or productivity growth. (Janson, 2012)
  - An important factor affecting the sustainable development of urban e-commerce logistics.

	Sub-criteria	Definition	Reference
[M4] Economic Aspect	Costs (S10)	The comprehensive sum of expenses incurred throughout the end-to-end supply chain processes, including procurement, transportation, storage, handling, and distribution of goods	Guihang et al., 2021
	Technology capability (S11)	An organization's inherent capacity and proficiency in leveraging technological resources to enhance operational processes, innovate business models, and gain a competitive edge	Gheitarani et al., 2022
	Urban Distribution System (S12)	Characterized as measures implemented by the public sector to regulate freight transport	Alexandra et al., 2016

Proposed Factors

- **[M5] Environmental Aspect**
  - Definition: The environmental viewpoint within a sustainable logistics system comprises the negative consequences of energy consumption, waste disposal, pollution, and emissions. (Wichaisri and Sopadang, 2014)
  - Studies have shown the environmental impacts in cities due to the increase in last-mile logistics (Abbasi and Nilsson, 2016). However, there have been notable efforts to mitigate these environmental impacts.

	Sub-criteria	Definition	Reference
[M5] Environmental Aspect	[S13] Green Vehicle	Vehicles that are environmentally friendly and cause less harm to the environment compared to conventional vehicles.	Islam and Gajpal, 2021
	[S14] Green packaging	Ecological and safe materials used for packing purposes.	Pauer et al., 2019
	[S15] Green warehouse	An approach of optimizing energy and space/layout for inventory/storage, minimizing movement.	Karia and Muhammah, 2016
	[S16] Green management systems	An approach of developing strategic planning, control and assessment logistics practices that enhance environment, economic and social sustainable development	Karia and Muhammah, 2016

Proposed Factors

- **[M6] Social Aspect**
  - Definition: The social perspective is one of the aspects of a sustainable logistics system which is based on the human resources component found in traditional logistics systems, divided into two criteria: quality of life and health and safety (S. Wichaisri and A. Sopadang, 2013)

	Sub-criteria	Definition	Reference
[M6] Social Aspect	[S17] Health and Safety	Individuals' well-being and safety within a society for the right to not only be safe, but to take every precaution of adaptation and security to avoid future casualties and physical harm.	Eizenberg and Jabareen (2017)
	[S18] Government regulations	Guidelines and standards for energy use, waste disposal, and emissions; along with offering incentives to logistics firms	Marchet et al. (2014)
	[S19] Customer satisfaction	Last-mile delivery directly linked to customer satisfaction and is increasingly subject to public expectations for sustainability in urban logistics	Siegfried (2021)
	[S20] Employee satisfaction	Caring for drivers' satisfaction will promote the sustainable development of last-mile delivery service.	Siegfried (2021)
	[S21] Cooperation among stakeholders to adapt change in customer behavior	Shaping perspectives of key stakeholders (local authorities, shippers and retailers, customers, delivery companies, etc.) to a more sustainable choice	Kiba-Janiak et al. (2021b)

Tables of related papers

No	References	Factors	
1	Silva et al (2023)	1. Costs (S10) 2. Technology capability (S11) 3. Urban Distribution System (S12)	4. Green Vehicle (S13) 5. Green packaging (S14)
2	Kiba-Janiak et al (2021)	1. Timeliness of goods delivery (S06) 2. Costs (S10) 3. Technology capability (S11) 4. Urban Distribution System (S12) 5. Green Vehicle (S13)	6. Health and Safety (S17) 7. Government regulations (S18) 8. Customer satisfaction (S19) 9. Cooperation among stakeholders to adapt change in customer behavior (S21)
3	Awwad et al (2018)	1. Costs (S10) 2. Technology capability (S11) 3. Urban Distribution System (S12) 4. Green Vehicle (S13) 5. Green warehouse (S15)	6. Green management systems (S16) 7. Health and Safety (S17) 8. Government regulations (S18) 9. Customer satisfaction (S19) 10. Employee satisfaction (S20)
4	Bosona (2020)	1. Convenience of setting the parcel receiving time (S02) 2. Convenience of delivery location (S03) 3. Convenience of returning goods (S04) 4. Timeliness of goods delivery (S06) 5. Accuracy of logistics information (S9) 6. Costs (S10) 7. Technology capability (S11) 8. Urban Distribution System (S12)	9. Green Vehicle (S13) 10. Green warehouse (S15) 11. Green management systems (S16) 12. Health and Safety (S17) 13. Government regulations (S18) 14. Customer satisfaction (S19) 15. Employee satisfaction (S20) 16. Cooperation among stakeholders to adapt change in customer behavior (S21)
5	Marte et al (2020)	1. Convenience of delivery location (S03) 2. Costs (S10) 3. Technology capability (S11) 4. Urban Distribution System (S12) 5. Green Vehicle (S13) 6. Green packaging (S14)	7. Green warehouse (S15) 8. Green management systems (S16) 9. Health and Safety (S17) 10. Government regulations (S18) 11. Cooperation among stakeholders to adapt change in customer behavior (S21)

No	References	Factors	
6	Wang, Nguyen, et al. (2021)	1. Convenience of setting the parcel receiving time (S02) 2. Timeliness of customer service response (S05) 3. Timeliness of goods delivery (S06) 4. Accuracy of goods arrival (S08) 5. Accuracy of logistics information (S9) 6. Costs (S10) 7. Technology capability (S11) 8. Urban Distribution System (S12)	9. Green Vehicle (S13) 10. Green packaging (S14) 11. Green warehouse (S15) 12. Green management systems (S16) 13. Health and Safety (S17) 14. Government regulations (S18) 15. Customer satisfaction (S19) 16. Cooperation among stakeholders to adapt change in customer behavior (S21)
7	Ranieri et al. (2018)	1. Accuracy of logistics information (S9) 2. Costs (S10) 3. Technology capability (S11)	4. Urban Distribution System (S12) 5. Green Vehicle (S13) 6. Government regulations (S18)
8	Siegfried and Zhang (2021)	1. Convenience of setting the parcel receiving time (S02) 2. Convenience of delivery location(S03) 3. Convenience of returning goods (S04) 4. Accuracy of goods arrival (S08) 5. Accuracy of logistics information (S9) 6. Costs (S10) 7. Technology capability (S11)	8. Urban Distribution System (S12) 9. Green Vehicle (S13) 10. Green warehouse (S15) 11. Green management systems (S16) 12. Health and Safety (S17) 13. Government regulations (S18) 14. Customer satisfaction (S19) 15. Employee satisfaction (S20)
9	Ignat and Chankov (2020)	1. Convenience of setting the parcel receiving time (S02) 2. Convenience of delivery location(S03) 3. Timeliness of goods delivery (S06) 4. Technology capability (S11) 5. Urban Distribution System (S12) 6. Green Vehicle (S13)	7. Green packaging (S14) 8. Health and Safety (S17) 9. Government regulations (S18) 10. Customer satisfaction (S19) 11. Employee satisfaction (S20) 12. Cooperation among stakeholders to adapt change in customer behavior (S21)

Research Gap

01

International research's shortcoming
- Lack of foreign studies in the urban LMD context
- The shortcoming of studies towards multidimensional perspectives in combining Service quality dimension with TBL aspects.

02

Local Research Initiatives
- There is currently a lack of research studies in Vietnam's urban context
- Mostly evaluating customer perspectives (buyer-side) as a development basis of delivery services providers.
- Small scopes of the studies

Need a study that contributes to proposing the complexities of modern urban delivery sustainability and a concrete foundation to approach sustainable development.

03. METHODOLOGY

1/ Research philosophy

Pragmatism: Seek an appropriate balance by emphasizing the use and application of research results rather than an all-or-nothing, mutually exclusive philosophical perspective.

2/ Research approach

Inductive approach: find themes and patterns then develop conceptual framework.

3/ Research method

Quantitative and Qualitative: Use both quantitative and qualitative data to strengthen the strengths of one form of data while balancing the constraints of its disadvantages.

Data Collection Method

1/ Primary data

Face-to-face questionnaires: Structured interviews and questionnaires with 10 experts of LMD in Vietnam's urban areas.

2/ Secondary data

Documentary secondary data: Include government publications, books, journal articles, and newspapers.

3.2 Expert Selection Method

Purposive sampling: Choose individuals with expertise in LMD operations, given the nuances of our research questions and objectives.

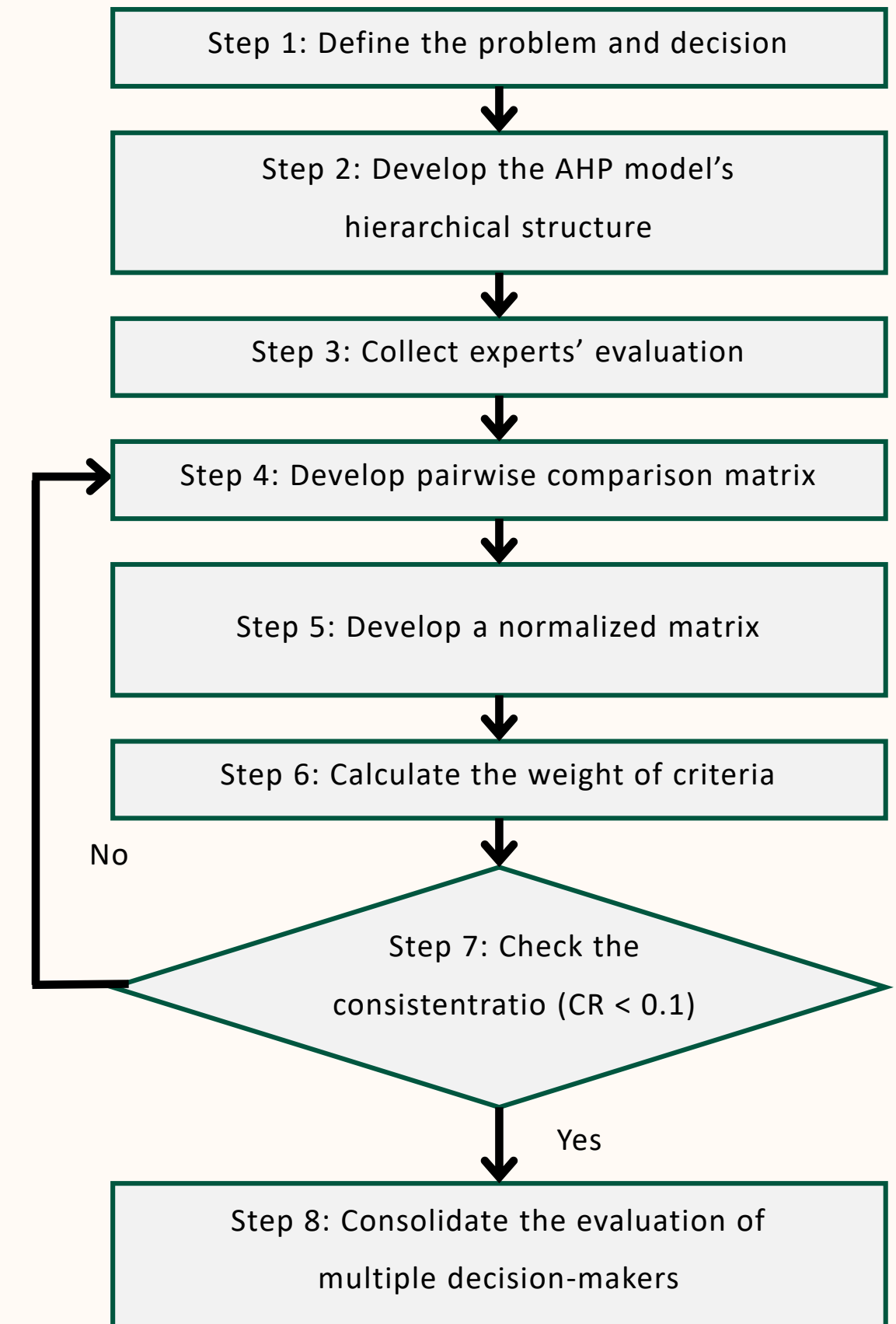### a/ High professional qualification

- Having academic degrees recognized by competent authorities (Master's Degree or PhD in logistics area)
- Having research papers about last-mile logistics featured in widely recognized academic publications.

b/ Have at least 5 years of experience

- Having at least 5 years of working experience in the field of Vietnam logistics and supply chain, preferably Vietnam Urban E-commerce last-mile delivery.

Expert	Experience	Education	Skilled field
Expert 1	5-10 years	Doctor of Philosophy	Logistics and Supply Chain Management
Expert 2	5-10 years	Doctor of Philosophy	Logistics and Supply Chain Management
Expert 3	5-10 years	Bachelor Degree	Freight Forwarding
Expert 4	More than 10 years	Master Degree	Logistics and Supply Chain Management
Expert 5	More than 10 years	Master Degree	E-commerce Business Owner
Expert 6	More than 10 years	Master Degree	Logistics and Supply Chain Management
Expert 7	More than 10 years	Master Degree	Logistics and Supply Chain Management
Expert 8	5-10 years	Bachelor Degree	Logistics and Supply Chain Management
Expert 9	5-10 years	Bachelor Degree	Logistics and Supply Chain Management
Expert 10	5-10 years	Bachelor Degree	Logistics and Supply Chain Management

AHP Model and Applications

- Definition: The Analytic Hierarchy Process (AHP) method was invented in 1980 by Saaty, a decision-making method based on hierarchical analysis.

- AHP is particularly adept at assisting individuals or groups of experts in resolving complex decision-making dilemmas.

- Used in many research in different areas, especially logistics and last-mile logistics.

Step 1: Define the problem and decision

Step 2: Develop the AHP model's hierarchical structure

Step 3: Collect experts' evaluation

Step 4: Develop pairwise comparison matrix

Step 5: Develop a normalized matrix

Step 6: Calculate the weight of criteria

No

Step 7: Check the consistentratio (CR < 0.1)

Yes

Step 8: Consolidate the evaluation of multiple decision-makers

Figure 3.1 Flowchart of proposed AHP method

Why We Use AHP in Our Research?

Reason 1: AHP has well-established track record in logistics research

Reason 2: Our research objective to rank multiple criteria aligns with AHP's capability

1/ Filiz Mizrak applied the AHP technique to construct a systematic framework for prioritizing risk and crisis management strategies in the logistics sector based on their relevance and potential impact (Filiz Mizrak,2023)

2/ Urza-Morales et al. defined the technique of relative weights through the AHP methodology in their research, particularly in the context of selecting transport systems (Urzúa-Morales et al., 2020)

3/ Gurcan et al. effectively determined a suitable third-party logistics provider by evaluating both tangible and intangible criteria (Gürcan et al., 2016)

4/ Kauf and Tłuczak have affirmed that the AHP method represents the most suitable approach for identifying optimal locations for logistics centers, thereby streamlining supply chain operations. (Kauf and Tłuczak, 2018)

#Step 1: Define the problem and decision objectives
#Step 2: Develop the AHP model's hierarchical structure
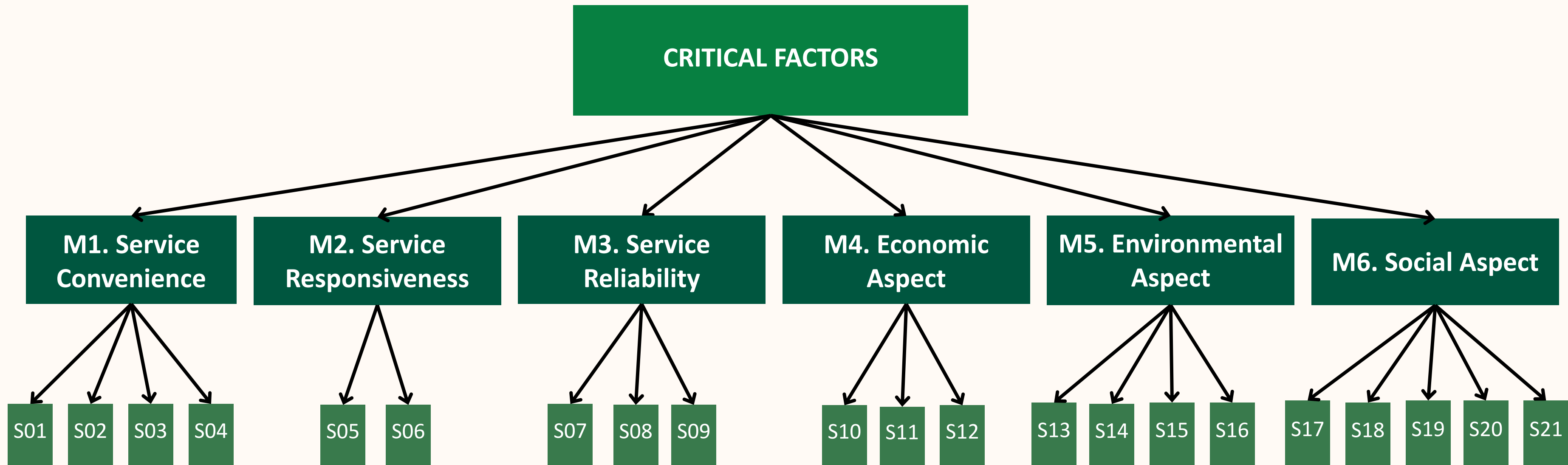
Figure 3.2 *The hierarchical structure of the criteria set (Authors)*

#Step 3: Collect experts' evaluation
Saaty's point scale (1988)

Semantics	Grade	Reciprocal*
Equal important	1	1
Moderately more important	3	1/3
Strongly more important	5	1/5
Very strongly more important	7	1/7
Extremely more important	9	1/9
Compromise/between	2, 4, 6, 8	1/2, 1/4, 1/6, 1/8

* Reciprocal: In comparing elements i and j
- If i is 3 compared to j
- then j is 1/3 compared to i

Expert 1's raw data

	Economic Aspect																	
	Left Criteria is greater									Right Criteria is greater								
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Costs							x											Technology Capability
Costs								x										Urban Distribution System
Technology Capability									x									Urban Distribution System

Check the CR | Consolidate the evaluation | Ranking Table | +

Data Analysis Method

#Step 3: Collect Experts' Evaluation

- In each brand, we develop one comparison matrix. There are 7 matrix in this study:

- Main criteria

- Service Convenience sub-criteria

- Service Responsiveness sub-criteria

- Service Reliability sub-criteria

- Economic Aspect sub-criteria

- Environmental Aspect sub-criteria

- Social Aspect sub-criteria

- The important level of criteria and sub-criteria is scored by experts using Saaty's point scale.

Table 3.1 *Saaty's point scale*

Semantics	Grade	Reciprocal
Equal important	1	1
Moderately more important	3	1/3
Strongly more important	5	1/5
Very strongly more important	7	1/7
Extremely more important	9	1/9
Compromise/between	2, 4, 6, 8	1/2, 1/4, 1/6, 1/8

Example: Expert 1's data for M4

	Economic Aspects																			
	Left Criteria is greater									Right Criteria is greater									
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Costs (S10)							x											Technology Capability (S11)
Costs (S10)								x										Urban Distribution System (S12)
Technology Capability (S11)									x									Urban Distribution System (S12)

#Step 4 & 5: Develop pairwise comparison and normalize matrix

- Divide element by the total number of its columns

Formula:

$$C_{ij} = \frac{A_{ij}}{\sum_{i=1}^{n} A_{ij}} \begin{bmatrix} C_{11} & C_{12} & \dots & C_{1n} \\ C_{21} & C_{22} & \dots & C_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ C_{n1} & C_{n2} & \dots & C_{nn} \end{bmatrix} \quad (2)$$

Step 1: Define the problem and decision

⬇

Step 2: Develop the AHP model's hierarchical structure

⬇

Step 3: Collect experts' evaluation

⬇

Step 4: Develop pairwise comparison matrix

⬇

Step 5: Develop a normalized matrix

M4	S10	S11	S12
S10	1	3	2
S11	1/3	1	1
S12	1/2	1	1

→

M4	S10	S11	S12
S10	0.55	0.60	0.50
S11	0.18	0.20	0.25
S12	0.27	0.20	0.25
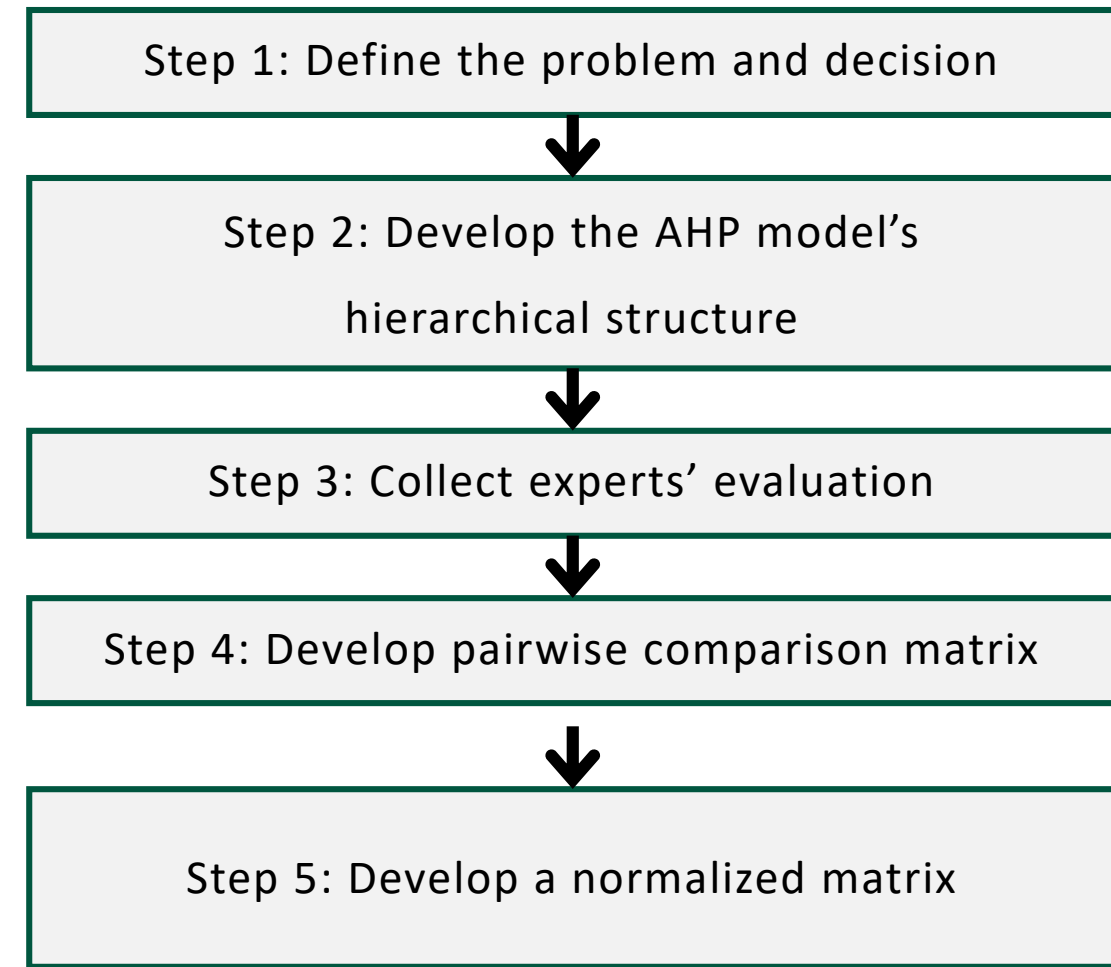
#Step 6: Calculate the weight of criteria

- Dividing the total of the normalized row in the matrix by the number of criteria utilized

Formula:

$$W_{ij} = \frac{\sum_{i=1}^{n} C_{ij}}{n} \begin{bmatrix} W_{11} \\ W_{21} \\ \vdots \\ W_{n1} \end{bmatrix} \quad (3)$$

$$=> \quad W_{11} = \frac{0.55 + 0.6 + 0.5}{3} = 0.55$$

M4	S10	S11	S12	Criteria weight
S10	0.55	0.60	0.50	0.55
S11	0.18	0.20	0.25	0.21
S12	0.27	0.20	0.25	0.24

Step 4: Develop pairwise comparison matrix

Step 5: Develop a normalized matrix

Step 6: Calculate the weight of criteria

No

Step 7: Check the consistentratio (CR < 0.1)

Yes

Step 8: Consolidate the evaluation of multiple decision-makers

#Step 7: Check the CR

$$CR = \frac{CI}{RI} \quad (4) \quad ; \quad CI = \frac{\lambda_{max} - n}{n-1} \quad (5)$$

Where λmax is the consistency vector, that is, the averaged value of each of calculated eigenvectors

- CR< 0.1 is considered consistency acceptable.
- Otherwise, we should ask the experts to review and potentially revise their judgments.

Table 3.2 *Random Index (RI). (Saaty, 1988)*

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.00	0.00	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.58

Data Analysis Method
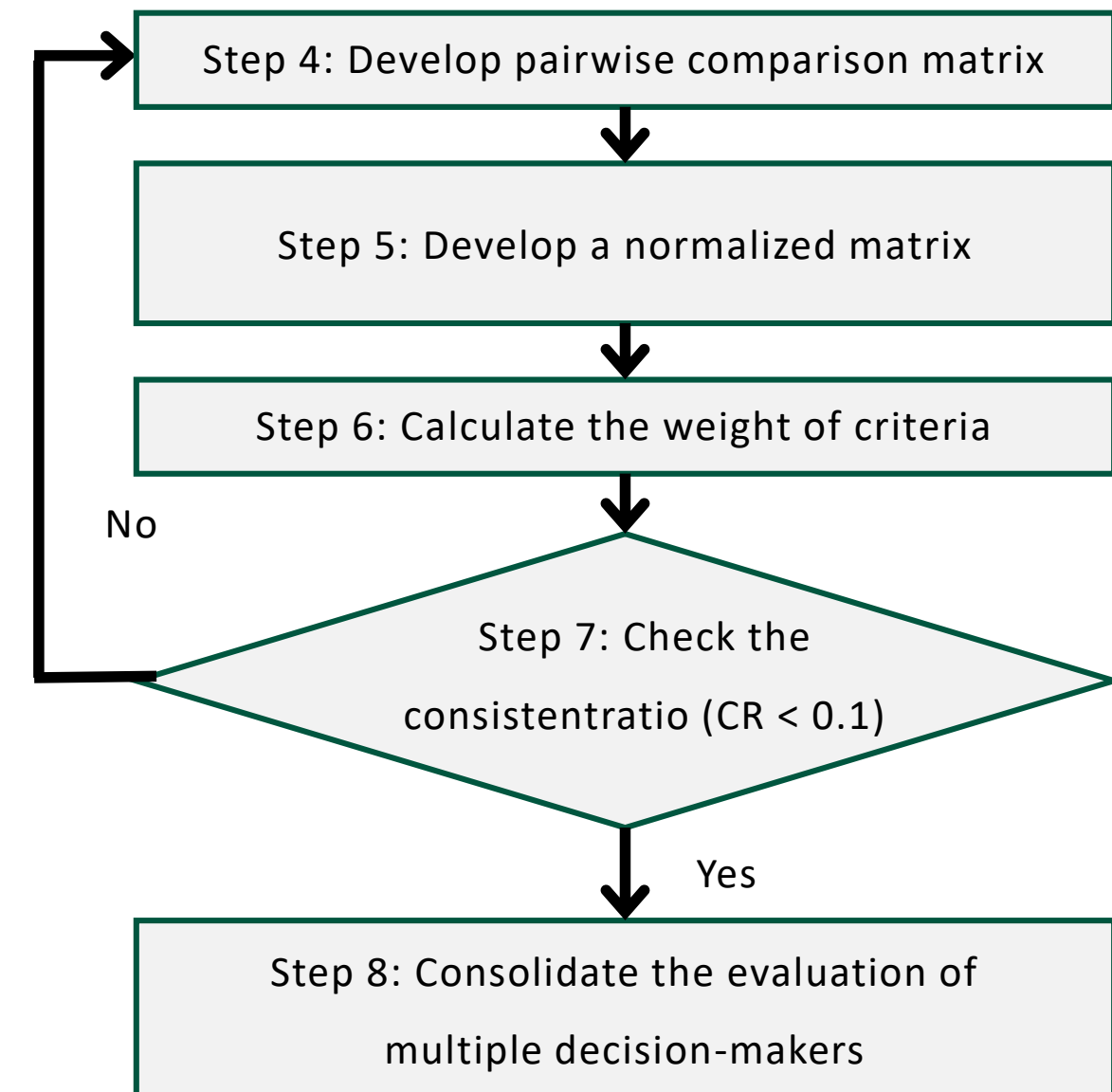
#Step 7: Check the CR

Formula: $\lambda_{\max} = \frac{1}{n}\sum_{i=1}^{n}\frac{A_{ij}*w_j}{w_i}$ (6)

$\Rightarrow \lambda_{\max} = \dfrac{3.03 + 3.01 + 3.01}{3} = 3.02$

M4	S10	S11	S12
S10	1	3	2
S11	1/3	1	1
S12	1/2	1	1

M4	S10	S11	S12	Criteria weight
S10	0.55	0.60	0.50	0.55
S11	0.18	0.20	0.25	0.21
S12	0.27	0.20	0.25	0.24

$$\begin{bmatrix} 1 & 3 & 2 \\ 1/3 & 1 & 1 \\ 1/2 & 1 & 1 \end{bmatrix} \times \begin{bmatrix} 0.55 \\ 0.21 \\ 0.24 \end{bmatrix} = \begin{bmatrix} 1.66 \\ 0.63 \\ 0.73 \end{bmatrix}$$

$$\begin{bmatrix} 1.66 \\ 0.63 \\ 0.73 \end{bmatrix} / \begin{bmatrix} 0.55 \\ 0.21 \\ 0.24 \end{bmatrix} = \begin{bmatrix} 3.03 \\ 3.01 \\ 3.01 \end{bmatrix}$$

- From (5), n=3 and $\lambda_{\max}$ = 3.02 => CI = 0.01

From (6), CI= 0.01 and RI = 0.58 (Table 3.2) => CR = 0.013 < 0.1 (Acceptable Inconsistency for M4's evaluation of Expert 1)

#Step 8: Consolidate the evaluation of multiple respondents.

- Geometric mean was employed.
- Gather the data and calculate the final CR in Excel Software.

Formula:

$$\prod_{i=1}^{n} a_i = \sqrt[n]{a_1 a_2 \dots a_n} \quad (7)$$

Where:
- a= Pairwise comparison scale is given by an expert
- n = Number of experts

Main Criteria	Sub Criteria	Priorities	Local Rank	Synthesized Priorities	Global Rank
M1	S01	0.141	4	0.016	20
	S02	0.377	1	0.043	10
	S03	0.327	2	0.037	11
	S04	0.155	3	0.018	19
M2	S05	0.339	2	0.028	15
	S06	0.661	1	0.055	7
M3	S07	0.524	1	0.12	2
	S08	0.242	2	0.055	6
	S09	0.234	3	0.054	8
M4	S10	0.494	1	0.125	1
	S11	0.141	3	0.035	12
	S12	0.365	2	0.092	3
M5	S13	0.185	3	0.026	17
	S14	0.477	1	0.066	4
	S15	0.188	2	0.026	16
	S16	0.15	4	0.021	18
M6	S17	0.168	4	0.031	14
	S18	0.261	2	0.048	9
	S19	0.306	1	0.056	5
	S20	0.079	5	0.015	21
	S21	0.186	3	0.034	13

04. FINDINGS & ANALYSES

Table 4.1 *Author's analysis*

Main Criteria	Sub Criteria	Priorities	Local Rank	Synthesized Priorities	Global Rank
M1	S01	0.141	4	0.016	20
	S02	0.377	1	0.043	10
	S03	0.327	2	0.037	11
	S04	0.155	3	0.018	19
M2	S05	0.339	2	0.028	15
	S06	0.661	1	0.055	7
M3	S07	0.524	1	0.12	2
	S08	0.242	2	0.055	6
	S09	0.234	3	0.054	8

Main Criteria	Sub Criteria	Priorities	Local Rank	Synthesized Priorities	Global Rank
M4	S10	0.494	1	0.125	1
	S11	0.141	3	0.035	12
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	S14	0.477	1	0.066	4
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	S18	0.261	2	0.048	9
	S19	0.306	1	0.056	5
	S20	0.079	5	0.015	21
	S21	0.186	3	0.034	13

1. Priorities: the weights assigned to the elements within a specific criterion.
2. Local Rank: the ranking of alternatives within a specific criterion based on the computed local priorities
3. Synthesized Priorities: the computed weights of an element considering its weight within the entire hierarchy.
4. Global Rank: the overall ranking of alternatives across all sub-criteria based on the computed synthesized priorities.

01

Economic aspect criterion (M4) is the criterion with the highest priority (0.252).

02

5 most influential sub-criteria include:
- Costs (S10)
- Integrity Of Goods (S7)
- Urban Distribution System (S12)
- Green Packaging (S14)
- Customer Satisfaction (S19)

Economic Aspect

- Vietnam's logistics industry is facing many challenges.

  (National Institution for Finance)

- Vietnamese logistics companies have been applying solutions to achieve economic benefits: cost optimization, investment in technology, cooperation in logistics activities, etc.
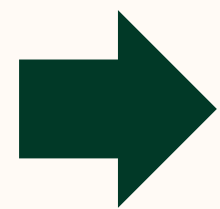
➡️ With the current situation of the logistics industry, focusing on the Economic Aspect in the initial step of developing sustainability in LMD

1
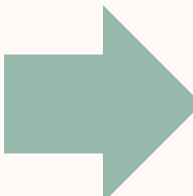
Cost (S09)

- Logisics plays a particularly important role in creating a competitive advantage.
- Last-mile delivery represents a significant financial expenditure and the most polluting part of the entire supply chain.

  (Kin et al., 2018, Visser et al., 2014)

- Finding solutions to reduce logistics costs in order to gain the competitive advantage is an urgent issue.

  (Phuong, 2019)

Reducing logistics costs is an important task to enhance the sustainability of Vietnam's supply chain.

② Integrity Of Goods (S07)

- Assuring customer satisfaction, regulatory compliance, and maintaining brand reputation

(Phuong, 2020)

- Distributors lack the information to monitor the temperature and condition of goods during delivery process, which remains a key aspect for improvement

(Hoang, 2019)

- Preserving product quality during transportation and storage is essential for customer retention and market competitiveness

(Nguyen and Le, 2021)
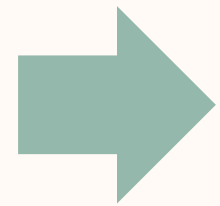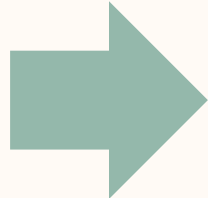
Maintaining the integrity of goods during this period can improve a company's reputation and customer satisfaction, leading it to obtain a competitive advantage

3 **Urban Distribution System (S12)**

- Urban Distribution System is necessary for last-mile delivery activities to increase service efficiency, save costs, and reduce emissions
- Developing urban distribution centers in strategic metropolitan locations helps logistics companies optimize vehicle use and reduce delivery times.
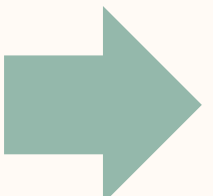
➡️ Urban distribution systems benefit economic growth, reduce environmental impact, and enhance logistics in densely populated areas.

4 **Green Packaging (S14)**

- E-commerce growth has increased LMD services, leading to more packaging waste and environmental pollution concerns.

(Wang et al., 2022)

- Companies should use sustainable materials, minimize one-time packaging, and ensure proper packaging.

(Zhang & Zhao, 2012)

- The government can pass legislation to incentivize green packaging, such as reduced tax for recycled materials or promotion of new packaging systems.

Green packaging has become a significantly important solution to reduce waste and environmental pollution, thereby promoting sustainable development
(Wandosell et al., 2021)

⑤ Customer Satisfaction (S19)

- When completing online transactions, consumers can enjoy ease, simplicity, and time efficiency thanks to LMD.

(Chen and Dubinsky, 2003)

- Despite having multiple investments, many small businesses fail to compete for customer satisfaction against larger platforms.
- Customer satisfaction is crucial for repeat sales, consumer loyalty, and overall company performance.

(Xenophon et al.,2014)

➡ Maintain increasing consumer satisfaction in order to cultivate client loyalty and create competitive advantage.

05. CONCLUSIONS & IMPLICATIONS

1/ Context

LMD development is compulsory for sustainable eCommerce growth in Vietnam's urban area. This research aims to identify the list of criteria that are important for LMD development.

2/ Methodology

Collecting multiple experts' literature reviews and synthesis of experts' opinions on each criteria
Using the AHP method to analyze and define the most impactful factors

3/ Final outcome

From a set of 6 main criteria and 21 sub-criteria, this research provides a ranking system so logistic companies can use this research for resourcing allocation and sustainable development planning

Limitation and Future research

1/ Scope limited in urban area

This research focuses most on urban areas where eCommerce is most developed

Future: cross-border/long range

Future research can expand the scope of delivery range to between provinces and nation

2/ Ignore some external factors

This research didn't take infrastructure geography, or education as factors.

Future: take into account external factors

Future research can take these external factors into account.

3/ Only focus on E-commerce

This research focuses on last-mile delivery in eCommerce only

Future: other logistic chains

Future research can replicate the same research for other logistic chains

Implication

1/ Useful managerial insights

The criteria developed through rigorous analysis and expert insights offer actionable guidance to enhance sustainability, reduce costs, and improve customer satisfaction.

2/ Foundation for future research

Future research can use this research paper as guidance since we already propose a set of highly related criteria along with a clear methodology on how to collect and analyze data.

References

Abbasi, M. and Nilsson, F. (2016). 'Developing environmentally sustainable logistics: Exploring themes and challenges from a logistics service providers' perspective'. Transportation Research Part D: Transport and Environment, 46, pp. 273–283.

Aggarwal, Rashmi, and Anchal (2023). "Significance of Ecommerce in Emerging Markets." Enhancing Customer Engagement Through Location-Based Marketing, edited by Amandeep Singh, et al., IGI Global, 2023, pp. 18-25.

Agility (2023). Rankings | Agility Emerging Markets Logistics Index. Available at: https://www.agility.com/en/emerging-markets-logistics-index/rankings/ (Accessed: 16 November 2023).

Alexandra et al. (2016). Urban Distribution Centers: doomed to fail or optimal solutions for last mile deliveries. Research Gate. Available at: https://www.researchgate.net/publication/327424153_Urban_Distribution_Centers_doomed_to_fail_or_optimal_solutions_for_last_mile_deliveries. (Accessed: 17 November 2023).

An, H. et al. (2021). 'Nexus between green logistic operations and triple bottom line: evidence from infrastructure-led Chinese outward foreign direct investment in Belt and Road host countries'. Environmental Science and Pollution Research, 28(37), pp. 51022–51045.

Arabelen, G. and Kaya, H.T. (2021). 'Assessment of logistics service quality dimensions: a qualitative approach'. Journal of Shipping and Trade 2021 6:1. Vol. 6(1), pp. 1–13.

Bosona, T. (2020). Urban freight last Mile Logistics—challenges and opportunities to improve sustainability: A literature review. Sustainability, 12(21), 8769. doi:10.3390/su12218769

Chen, L. et al. (2023). 'Supply chain learning and performance: a meta-analysis', International Journal of Operations & Production Management [Preprint]. Available at: https://doi.org/10.1108/IJOPM-05-2022-0289.

Chen, Z. and Dubinsky, A.J. (2003). 'A conceptual model of perceived customer value in e-commerce: A preliminary investigation'. Psychology & Marketing, 20(4), pp. 323–347.

Department of E-commerce and Digital Economy (2022). [PDF] Vietnam E-commerce white paper 2022.

Eizenberg, E. and Jabareen, Y. (2017). 'Social Sustainability: A New Conceptual Framework'. Sustainability. Vol. 9, Page 68, 9(1), p. 68.

Gheitarani, F. et al. (2022) 'Identifying Dimensions of Dynamic Technological Capability: A Systematic Review of the Last Two Decades of Research'. Available at: https://doi.org/10.1142/S0219877022300026.

Guihang, G., Yanqin, W. and Chuyao, G. (2021). 'Research on Logistics Cost Control of E-commerce Enterprise from the Perspective of Value Chain– A Case Study of Pinduoduo'. International Journal of Economics and Finance. Vol. 13(7), pp. 42.

Hoang, T. (2019). 'Last-mile delivery for e-Commerce in Vietnam: Current situation and future challenges'. Available at: http://www.theseus.fi/handle/10024/261529 (Accessed: 19 November 2023).

Ignat, B., & Chankov, S. (2020). Do e-commerce customers change their preferred last-mile delivery based on its sustainability impact? The International Journal of Logistics Management, 31(3), 521–548. doi:10.1108/ijlm-11-2019-0305

References

Islam, M.A. and Gajpal, Y. (2021). 'Optimization of Conventional and Green Vehicles Composition under Carbon Emission Cap'. Sustainability. Vol. 13, Page 6940, 13(12), p. 6940.

Iveta et al. (2014). Logistics Information and Communication Technology. Communications - Scientific Letters of the University of Zilina 2014. 16(2), pp. 9-13.

Janson (2012). 'The challenges of Impact Assessment'. Available at: https://repository.fteval.at/id/eprint/120/ (Accessed: 17 November 2023).

Jiang, X. et al. (2019).'Using the FAHP, ISM, and MICMAC approaches to study the sustainability influencing factors of the last mile delivery of rural e-commerce logistics'. Sustainability. Vol. 11(14).

Karia, N., Abu, M.H. and Asaari, H. (2016).Transforming green logistics practice into benefits-A case of 3PLs Transforming green logistics practice into benefits: a case of third-party logistics (3PLs). Available at: https://www.researchgate.net/publication/299534458.

Kiba-Janiak, M. et al. (2021).'Sustainable last mile delivery on e-commerce market in cities from the perspective of various stakeholders. Literature review'. Sustainable Cities and Society. Vol. 71, p. 102,984.

Kiba-Janiak, M., Marcinkowski, J., Jagoda, A., & Skowrońska, A. (2021). Sustainable last mile delivery on e-commerce market in cities from the perspective of various stakeholders. literature Review. Sustainable Cities and Society, 71, 102984. doi:10.1016/j.scs.2021.102984

Kin, B. et al. (2018).'Modelling alternative distribution set-ups for fragmented last mile transport: Towards more efficient and sustainable urban freight transport'. Case Studies on Transport Policy. 6(1), pp. 125–132.

Lam Nguyen (2023). E-commerce development - Lesson 1: High growth, Electronic information portal of the Ministry of Finance. Available at: https://www.mof.gov.vn/webcenter/portal/ttpltc/pages_r/l/chi-tiet-tin-ttpltc?dDocName=MOFUCM274942 (Accessed: 17 November 2023).

Lan Anh (2022). Urban development in Vietnam - issues raised in the coming period, Vietnam Electronic information portal of the Ministry of Construction. Available at: https://moc.gov.vn/tl/tin-tuc/74077/phat-trien-do-thi-viet-nam-nhung-van-de-dat-ra-trong-giai-doan-toi (Accessed: 17 November 2023).

Li, S. et al. (2006).'The impact of supply chain management practices on competitive advantage and organizational performance'. Omega. 34(2), pp. 107–124.

Lim, S.F.W.T., Jin, X. and Srai, J.S. (2018).'Consumer-driven e-commerce: A literature review, design framework, and research agenda on last-mile logistics models'. International Journal of Physical Distribution and Logistics Management. Emerald Group Holdings Ltd., pp. 308–332.

Manerba, D., Mansini, R. and Zanotti, R. (2018).'Attended Home Delivery: reducing last-mile environmental impact by changing customer habits'. IFAC-PapersOnLine. 51(5), pp. 55–60.

Marchet, G., Melacini, M. and Perotti, S. (2014).'Environmental sustainability in logistics and freight transportation: A literature review and research agenda'. Journal of Manufacturing Technology Management. 25(6), pp. 775–811.

Nguyen, T.T.C. et al. (2021).'The effect of supply chain linkages on the business performance: evidence from Vietnam'. Uncertain Supply Chain Management, 9(3), pp. 529–538.

References

Norman, W. and MacDonald, C. (2004).'Getting to the Bottom of "Triple Bottom Line"'. Business Ethics Quarterly. 14(2), pp. 243–262.

Pauer, E. et al. (2019).'Assessing the Environmental Sustainability of Food Packaging: An Extended Life Cycle Assessment including Packaging-Related Food Losses and Waste and Circularity Assessment'. Sustainability. Vol. 11, Page 925, 11(3), p. 925.

Phuong, D.T. (2020).'Last-Mile Logistics in Vietnam in Industrial Revolution 4.0: Opportunities and Challenges', pp. 172–176.

Phuong, N.H. (2019).'Current status and solutions to reduce logistics costs in Vietnam'. Malaysian E Commerce Journal. 3(3), pp. 01–04.

Ranieri, L., Digiesi, S., Silvestri, B., & Roccotelli, M. (2018). A review of Last Mile Logistics Innovations in an externalities cost reduction vision. Sustainability, 10(3), 782. doi:10.3390/su10030782

Restuputri, D.P., Fridawati, A. and Masudin, I. (2022).'Customer Perception on Last-Mile Delivery Services Using Kansei Engineering and Conjoint Analysis: A Case Study of Indonesian Logistics Providers'. Logistics 2022. Vol. 6, Page 29, 6(2), p. 29.

Saaty, T.L. (1988).'What is the Analytic Hierarchy Process?', Mathematical Models for Decision Support, pp. 109–121. Available at: https://doi.org/10.1007/978-3-642-83555-1_5.

Siegfried, P. (2021). 'Developing a Sustainable Concept for the Urban Lastmile Delivery'. Available at: https://papers.ssrn.com/abstract=3980166 (Accessed: 10 October 2023).

Siegfried, P., & Zhang, J. J. (2021). Developing a sustainable concept for urban last-mile delivery. Open Journal of Business and Management, 09(01), 268–287. doi:10.4236/ojbm.2021.91015

Silva, V., Amaral, A., & Fontes, T. (2023). Sustainable urban last-mile logistics: A systematic literature review. Sustainability, 15(3), 2285. doi:10.3390/su15032285

Song, L. et al. (2016). 'Quantifying benefits of alternative home delivery operations on transport in China'. International Conference on Control, Automation and Systems. Vol.6, pp. 810–815.

Statista (2023). 'Share of the urban population in Vietnam from 2018 to 2022'. Available at: https://www.statista.com/statistics/761134/share-of-urban-population-vietnam/ (Accessed: 19 November 2023).

Tsagkias, M. et al. (2021). 'Challenges and research opportunities in eCommerce search and recommendations'. ACM SIGIR Forum. 54(1), pp. 1–23.

Uzir, M.U.H. et al. (2021). 'The effects of service quality, perceived value and trust in home delivery service personnel on customer satisfaction: Evidence from a developing country'. Journal of Retailing and Consumer Services. 63, p. 102721.

Van Duin, J.H.R. et al. (2020). 'From home delivery to parcel lockers: a case study in Amsterdam'.Transportation Research Procedia, 46, pp. 37–44.

Viet Dung (2023). 'Last-mile delivery challenges as e-commerce explodes'. Available at: https://baodautu.vn/thach-thuc-giao-hang-chang-cuoi-khi-thuong-mai-dien-tu-bung-no-d200046.html (Accessed: 17 November 2023).

References

Viet Hung (2019). Two trends and three challenges of Vietnam's transportation and logistics industry. Available at: https://mof.gov.vn/webcenter/portal/vclvcstc/pages_r/l/chi-tiet-tin?dDocName=MOFUCM144662 (Accessed: 18 November 2023).

Vietnam E-commerce and Digital Economy Agency (2023b). Report of Vietnam E-commerce 2023. Available at: www.idea.gov.vn.

Visser, J., Nemoto, T. and Browne, M. (2014). 'Home Delivery and the Impacts on Urban Freight Transport: A Review'. Procedia - Social and Behavioral Sciences. Vol. 125, pp. 15–27.

Viu-Roig, M., & Alvarez-Palau, E. J. (2020). The impact of e-commerce-related last-mile logistics on cities: A systematic literature review. Sustainability, 12(16), 6492. doi:10.3390/su12166492

Wandosell, G. et al. (2021a). 'Green packaging from consumer and business perspectives'. Sustainability. 13(3), pp. 1–19.

Wang, C.-N., Nguyen, N.-A.-T., Dang, T.-T., & Lu, C.-M. (2021). A compromised decision-making approach to third-party logistics selection in sustainable supply chain using fuzzy AHP and Fuzzy Vikor methods. Mathematics, 9(8), 886. doi:10.3390/math9080886

Wang, C.N., Nguyen, N.A.T., Dang, T.T. and Hsu, H.P. (2021). 'Evaluating Sustainable Last-Mile Delivery (LMD). in B2C E-Commerce Using Two-Stage Fuzzy MCDM Approach: A Case Study from Vietnam'. IEEE Access. 9, pp. 146050–146067.

Wang, Lun et al. (2022). 'A Review of Packaging Materials' Consumption Regulation and Pollution Control'. Sustainability. Vol. 14, Page 15866, 14(23), p. 15866.

Wichaisri, S. and Sopadang, A. (2014). 'Sustainable logistics system: A framework and case study'. IEEE International Conference on Industrial Engineering and Engineering Management, pp. 1017–1021

Wodnicka, M. and Skurpel, D. (2021). Reverse Logistics in Polish Commercial Companies from Economic and Management Perspective. European Research Studies Journal.

World Bank (2018), World Development Indicators (database), World Bank, Washington, DC.

Xenophon et al. (2014). Encounter Satisfaction in E-tailing: Are the relationships of order fulfillment service quality with its antecedents and consequences moderated by historical satisfaction?. Decision Sciences. Vol. 45, pp. 5-48.

Zarei, M.M., Chaparro-Peláez, J. and Agudo-Peregrina, Á.F. (2020b) 'Identifying consumer's last-mile logistics beliefs in omni-channel environment,' Ekonomska Istrazivanja-economic Research, 33(1), pp. 1796–1812. https://doi.org/10.1080/1331677x.2020.1760914.

Zhang, G. and Zhao, Z. (2012). 'Green Packaging Management of Logistics Enterprises'. Physics Procedi. Vol. 24, pp. 900–905.