FPT Education

FPT UNIVERSITY

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GRADUATION THESIS

A NOVEL APPROACH FOR STRATEGIC PARTNER SELECTION IN THE VIETNAMESE LOGISTICS INDUSTRY USING TWO-STAGE NON-PARAMETRIC DEA MODEL OF SUPER-SBM AND RESAMPLING FORECASTING TECHNIQUE

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RESEARCH TEAM: GRI491-G2

Tran Thi Lua
HS153032

Hoang Thi Ha
HE153425

Ngo Minh Tan
HS153244

Vu Duc Quang
HE151492

Nguyen Huu Giao Huy
HS153248

SUPERVISORS
NGUYEN PHI HUNG PH.D

THESIS OUTLINE

1. INTRODUCTION
2. LITERATURE REVIEW
3. METHODOLOGY
4. FINDINGS AND ANALYSIS
5. CONCLUSION

CHAPTER 1
INTRODUCTION

Topic Background

Research Objectives

Methodology and Data view

Research Question

Research Scope

1.1

TOPIC BACKGROUND

International trade has been gradually growing in recent years due to deepening and expanding globalization and economic interconnection.

Logistics as a component of the supply chain process that organizes, carries out, and manages the efficient, effective movement and storage of products, services, and associated information from the point of origin to the point of consumption.

Challenges

Navigating trade policies and tariffs, addressing infrastructure limitations, and managing geopolitical uncertainties.

Opportunities

Expand their global reach, forge strategic partnerships, and capitalize on the growing demand for efficient and cost-effective supply chain solution.

1.1

TOPIC BACKGROUND

Table 1.1: Vietnam's Logistics Performance Index (Worldbank, 2018)

Year	LPI Rank	LPI Score	Customs	Infrastructure	International Shipments	Logistics Quality/Competence
2018	39	3.27	2.95	3.01	3.16	3.4
2016	64	2.98	2.75	2.7	3.12	2.88
2014	48	3.15	2.81	3.11	3.22	2.88
2012	53	3	2.65	2.68	3.14	2.68
2010	53	2.96	2.68	2.56	3.04	2.89
2007	53	2.89	2.89	2.5	3	2.8

1.1

Practice Problem

80% of the enterprises that are now operating have registered capital between VND 1.5 and 2 billion

There is no link synchronization between businesses and across different stages of logistics activities

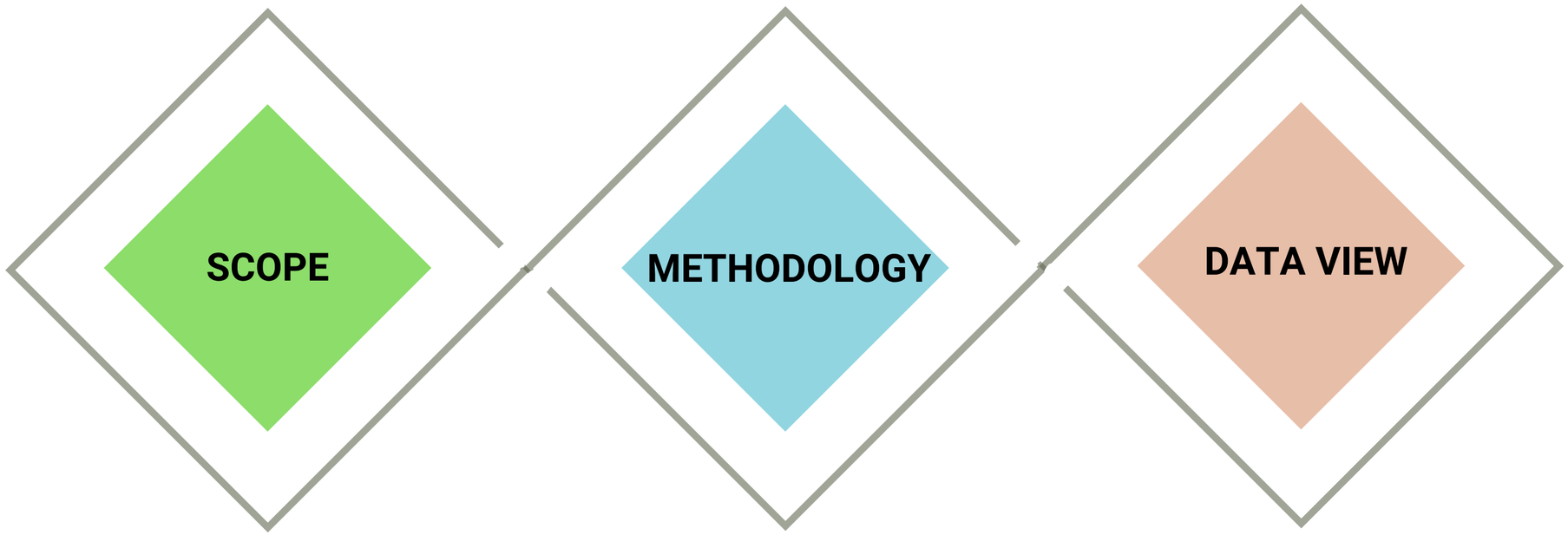
=> The goal of this study is to evaluate how well strategic alliances help Vietnamese logistics companies operate more effectively.

1.2 Research Questions and Objectives

Research Questions	Objectives
What is the efficiency score of the 22 logistics companies in Vietnam from 2013 to 2022?	Evaluate the performance of 22 logistics enterprises in Vietnam for ten consecutive years from 2013 to 2022.
What will be the efficiency scores before and after the implementation of the strategic alliance in the next five years, from 2023 to 2027?	Forecast and evaluate the effectiveness before and after the implementation of the strategic alliance in the next five years, from 2023 to 2027.
Which strategic alliances are appropriate for selection?	Compare the effectiveness before and after the implementation of the strategic alliance to make decisions for choosing the appropriate strategic alliance.

1.3

Methodology and Data view



22 companies' logistics in Vietnam from 2013 to 2022

DEA Super-SBM Resampling Model

The dataset used in this study is taken from Vietstock.vn and includes financial data from 2013 to 2022.

CHAPTER 2
Literature review

01 Literature Review on Logistics Industry

Literature Review on Strategic Alliance 02

03 Literature Review on Methods

Research Gaps 04

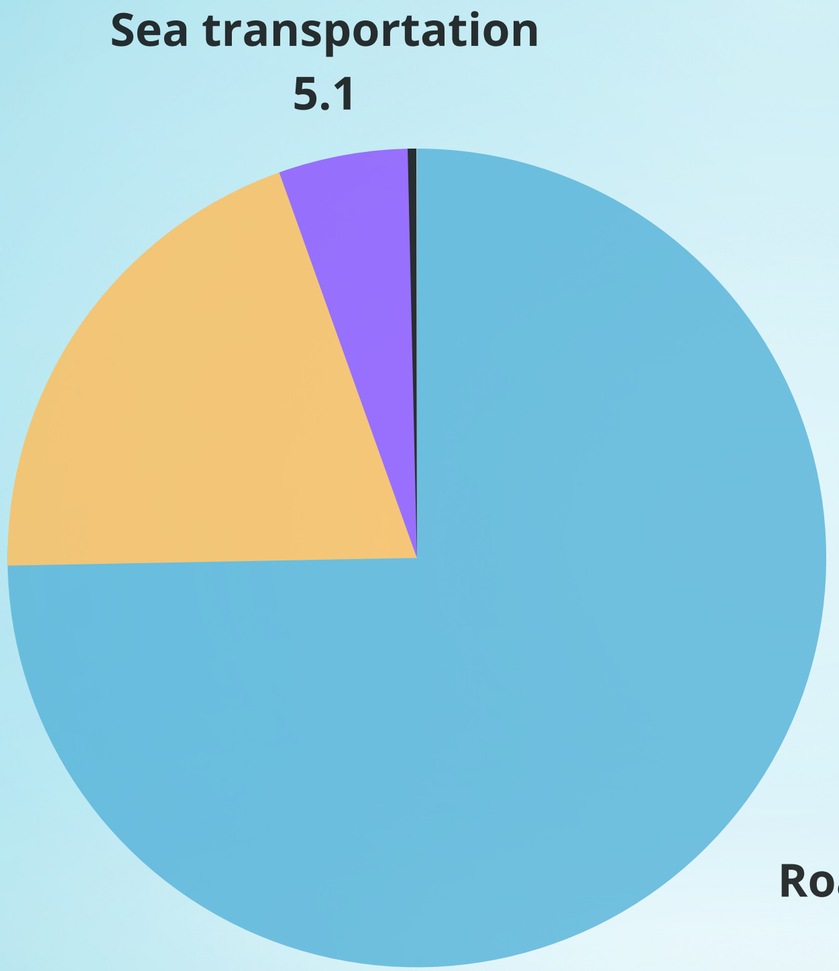
01 Literature Review on Logistics Industry

Overall Rankings | Domestic Logistics Opportunities | International Logistics Opportunities | Business Fundamentals | Digital Readiness

Agility Emerging Markets Logistics Index 2023

Ranking	Country	Domestic Opportunities	International Opportunities	Business Fundamentals	Digital Readiness	Overall
1	China	8.47	9.75	7.11	6.63	8.31
2	India	8.04	7.45	5.94	7.61	7.43
3	UAE	5.60	5.89	9.10	7.37	6.59
4	Malaysia	5.29	5.88	7.85	6.72	6.16
5	Indonesia	6.34	5.89	5.77	6.21	6.08
6	Saudi Arabia	5.38	5.74	7.86	6.30	6.07
7	Qatar	5.91	4.96	7.92	6.38	6.02
8	Thailand	5.11	5.98	5.77	6.04	5.67
9	Mexico	5.37	6.32	4.93	5.11	5.55
10	Vietnam	5.02	6.03	5.61	5.43	5.52
11	Turkey	5.14	5.70	5.80	5.50	5.49
12	Oman	4.95	4.88	7.24	5.81	5.46
13	Chile	4.83	5.18	7.01	5.55	5.43

2.1



Rail and air transportation have relatively comprising 0.34% and 0.02% of the total volume of goods transported during the same period, respectively (vneconomy.vn, 2022)

Chart 2.1: Models of Vietnam transportation during the quarter

2.2

Literature Review on Strategic Alliance

02

STRATEGIC ALLIANCES

Strategic alliances are collaborative agreements where two or more independent companies come together to work jointly on manufacturing, developing, selling products and services, or pursuing other common business objectives.

CFI provides that a strategic alliance refers to a collaborative arrangement between two distinct businesses that come together to collaborate on a project that benefits both parties while maintaining their independence (CFI, 2023)

03 Literature Review on Methods

2.3.1 Data Envelopment Analysis (DEA) Methods

Farrell (1957) pioneered the use of the Production Possibility Frontier (PPF) to gauge the relative efficiency of companies within a shared industry.

The Charnes-Cooper-Rhodes (CCR) method (1978) used non-parametric linear optimization to build the PPF from data on a set of companies (DMUs) and calculate their efficiency scores.

The Banker-Charnes-Cooper (BCC) model enhanced efficiency assessment by factoring in returns to scale, offering a more precise view of DMU efficiency

2.3.1 CONCEPT IN DEA

- DEA is a versatile method applicable to quantitative and qualitative variables. This flexibility renders it a valuable tool for analyzing DMU efficiency across sectors like education, healthcare, insurance, banking, securities, and business operations.

- One of the key advantages of DEA is that it is based on observed data, allowing it to be applied even with small sample sizes.

Super-SBM

2.3.1

Tone made further advancements to the model and introduced a new and enhanced version known as the Super-SBM model (Tone, 2002)

Allowing the efficiency of effective samples to surpass a value of 1

Handing input excess and output shortfall by incorporating the slacks into the objective function and providing a clear efficiency ranking for each efficient unit in comparison to other DMUs

2.3.1 RESAMPLING FORECASTING METHOD

1. Within the DEA offers a unique integrated approach that combines value forecasting and performance evaluation of DMUs during a specified period

2. This integration enables simultaneous value forecasting and performance estimation, making it a valuable tool for decision-making and planning

3. Supporting the estimation of future scores and providing insights into the confidence level associated with each DMU's performance (Tone and Ouenniche, 2016

4. Its distinctive ability to estimate future values and efficiency levels, providing a comprehensive understanding of a DMU's performance trajectory over time

2.4

Research Gaps

04

No.	Authors	Inputs	Outputs	Methods	Sample and Region
1	Wang et al. (2020)	Charter Capital, Total Asset, Selling Expense, General and Administrative Expense	Revenue Profit before tax	DEA Super-SBM-I-V model and GM (1,1)	Viet Nam, 16 companies in the Vietnam estate industry in the time period 2012-2017
2	Nguyen and Tran (2019)	Total assets, Liability, and COGS	Revenue and Operating profit	Malmquist, GM (1,1) and Super SBM	Viet Nam, 10 Logistic companies over six consecutive years (2011–2016)
3	Nguyen (2020)	Total asset, Total liability, Total operating expense	Revenue, Net income, Total equity	GM (1,1) and DEA-Super-SBM	15 businesses were chosen by Vietnam between 2013 and 2017 for 5-year data.
4	Wang et al. (2016)	Fixed assets, COGS, Operating expenses, and Long-term investment	Revenues, Total equity, and Net incomes	GM (1,1) and DEA-Super-SBM	International, The top 20 global automotive companies for four consecutive financial years (2009–2012)
5	Nguyen et al. (2015)	Fixed assets, Operating expenses, and COGS	Revenues, Operating income, and Retained earnings	GM (1,1), DEA and Super-SBM	20 EMS, capable of giving comprehensive data for four consecutive years, 2009 to 2012
6	Le et al. (2014)	Fixed assets, Capital, and Operating expenses	Net sales and Earnings per share (EPS)	GM (1,1) and DEA - Super-SBM	11 companies in the garment industry from financial statements of Vietnam published stock market during the period 2007 to 2010
7	Nguyen et al. (2020)	Fixed assets, COGS, Capital, Operating Costs	Net sales; Net profits	GM (1,1) and DEA Super-SBM	17 Vietnamese steel companies during the period of 2011–2019
8	Nguyen and Tran (2017)	Expenditure and Equity capital	Net income, Net profit, EPS	GM (1,1) and DEA Super-SBM	14 typical qualified companies for five continuous years (2010-2014)
9	Wang et al. (2022)	Fixed assets, Operating Cost, and COGS	Revenues and Operating profit	DEA and Grey Theory	Ten major coal mining projects of VINACOMIN during 2017–2021
10	Wang et al. (2018)	Property plant and equipment (PP&E), COGS, Operating expenses (OPEX), Long-term investment (LINV)	Gross profit (GP), net income (NI), common stock (CS), and retained earnings (RE)	GM (1,1), DEA and Super-SBM	The 35 biggest aerospace and military firms in the world's four most recent financial years (2012–2015)

No.	Authors	Inputs	Outputs	Methods	Sample and Region
11	Wang et al. (2021)	Total asset, Operating expense, R&D expenses, and Employees	Revenue and Gross profit	DEA-Super-SBM and Resampling Model	The realistic public data of 20 companies were collected from 2015 to 2019 in the I.C. packaging and testing industry.
12	Wang et al. (2008)	Assets, R&D Expenses, and Costs	Profits	Super-SBM, Grey System Theory, and DEA	8 TFT-LCD companies in Taiwan with five years of data (2003-2007)
13	Wang et al. (2016)	Fixed asset, R&D expenses, Cost of goods sold, Operating expense	Revenue, Retained earnings, and Net income	GM (1,1) and DEA - Super-SBM	20 companies are collected from 2011 to 2014
14	Wang et al. (2015)	Fixed assets, Operating expenses, and COGS	Revenues, Operating income, Retained earnings	GM (1,1) and DEA- Super-SBM	20 firms in the Electronic Manufacturing Service (EMS) sector operated throughout the course of four years (2009–2012)
15	Wang et al. (2008)	Employees, Total fixed assets, Total assets, R&D expense, Operating expense, and COGS	Net sales, Gross profit, Operating income, and Retained earning	DEA and GM (1,1)	11 companies of the Photovoltaic Industry during 2001- 2006
16	Nguyen et al. (2021)	Current assets, Non-current assets, Fixed assets, Liabilities, owner's equity, and Charter capital	Net revenue, Gross profit, Operating profit, and Net profit after tax	Super-SBM model	32 securities firms that were active between 2016 and 2019
17	Wang et al. (2018)	Total Assets Total Liabilities Total Equity	SG&A Expenses Revenue	DEA- SBM-I-V and GM (1,1)	11 public ASEAN aviation companies, according to realistic statistics, operated throughout the course of four years (2013–2016).
18	Min et al. (2016)	Operating Expenses (in thousand U.S. dollars) and Underutilization (in percentage)	Passengers, revenue passenger kilometers, Operating revenue, Service rating	DEA	Eight airlines for SkyTeam, 27 for Star Alliance, nine for Oneworld, and 15 for non-member airlines
19	Nguyen (2020)	Total assets, COGS, Total expense; Owners' equity	Net sales (N.S.); Profit after tax (P.T.)	DEA model, ARIMA model, and grey forecasting	14 companies with the data of enterprises in the period of 2015–2018
20	Tran (2018)	Fixed assets, COGS, operating costs	Net sales, Operating profit, Net profits	GM (1,1) and DEA - Super-SBM	11 fertilizer industry with five periods of data (2012-2016)

2.4

Research Gaps

01 Thesis on alliance logistics companies using DEA Resampling is rare

02 The data used is outdated, particularly concerning financial information

03 Incorporating a larger volume of input and output data

04 Groundbreaking and provides updated insights into the current situation

CHAPTER 3
METHODOLOGY

3.1. Research Procedure

3.3. DEA Models

3.3.1. DEA Original
3.3.2. Super-SBM
3.3.3. DEA Resampling Model

3.2. Data collection

3.1

Research Procedure

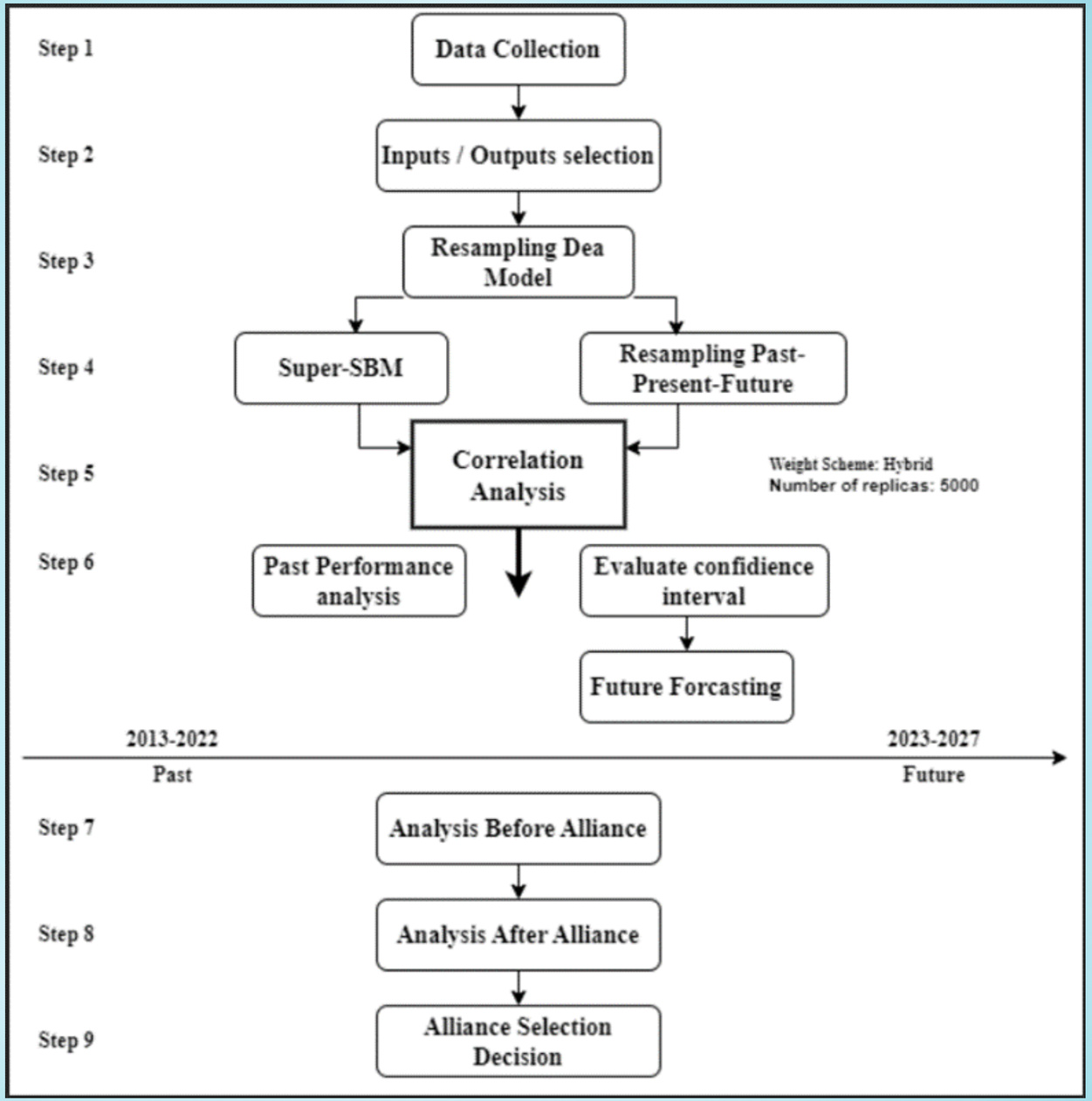


Figure 3.1. Proposed research framework

3.2

Table 3.1. List of DMUs

DMU1	An Giang Port JSC
DMU2	Dinh Vu Port Investment and Development JSC
DMU3	DoanXa Port JSC
DMU4	International Gas Product Shipping JSC
DMU5	Hai An Transport & Stevedoring JSC
DMU6	Hai Phong Cement Transport & Trading JSC
DMU7	Logistics Vicem JSC
DMU8	Danang Airports Services JSC
DMU9	Noi Bai Cargo Terminal Service JSC
DMU10	Dong Nai Port JSC
DMU11	Petrolimex Hanoi Transportation & Trading JSC

DMU12	Petrolimex Joint Stock Tanker Company
DMU13	Hai Phong Petrolimex Transportation & Services JSC
DMU14	Petrovietnam Transportation Corporation
DMU15	Sea & Air Freight International
DMU16	Superdong Fast Ferry Kieng Giang JSC
DMU17	Tan Cang Logistics & Stevedoring JSC
DMU18	Transimex Corporation
DMU19	Vietnam Petroleum Transport JSC
DMU20	Vietnam Maritime Development JSC
DMU21	Vietnam Sun Corporation
DMU22	Viet Nam Ocean Shipping JSC

3.2

Table 3.2: Definition of inputs/outputs variables

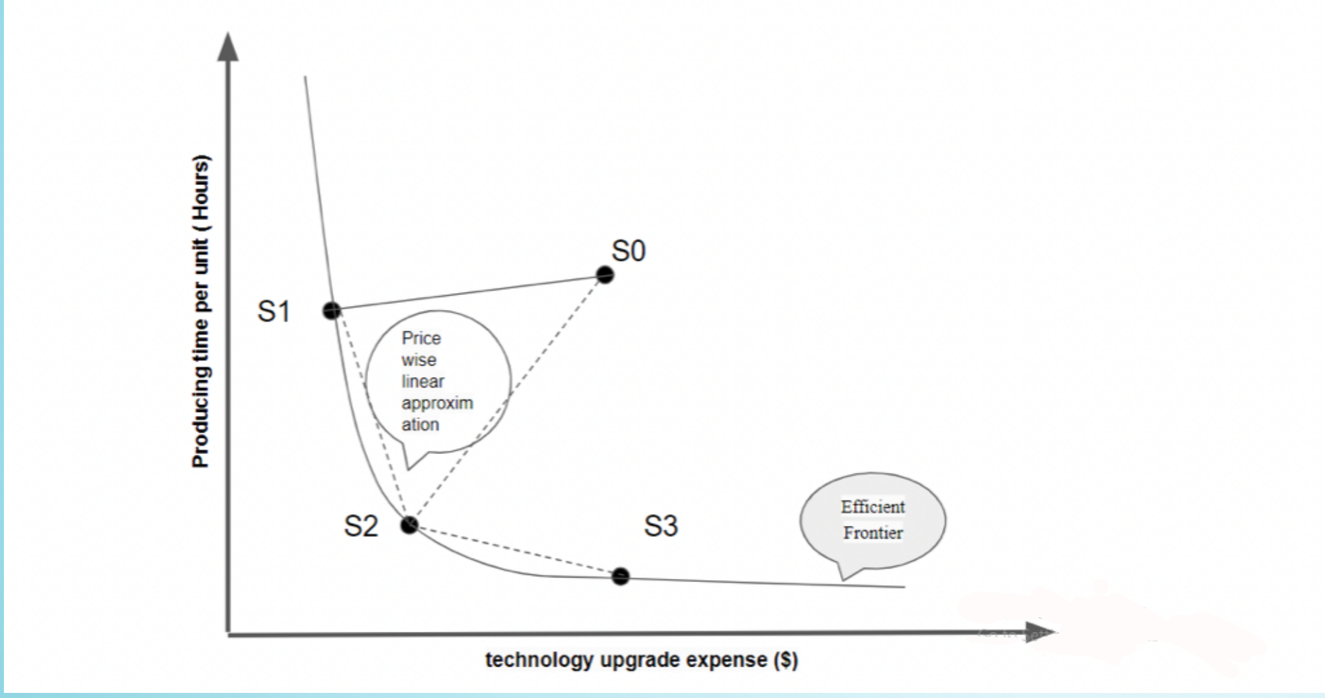
(I) Total Liabilities (TL)	Total liabilities refer to the aggregate amount of debts and obligations that a company or individual owes to other parties.
(I) Total Equity (TE)	Total equity, also known as shareholders' equity or owner's equity, represents the residual interest in the assets of a company or individual after deducting liabilities.
(I) Selling, General, and Administrative Expenses (SG&A)	SG&A expenses encompass various costs associated with selling, marketing, general administration, and other administrative functions within the company.
(I) Cost of Goods Sold (COGS)	COGS s an accounting term that represents the direct costs incurred in producing or acquiring the goods or services sold by a company.
(I) Inventory Turnover (IT)	Inventory turnover, also known as inventory turnover ratio or stock turnover, is a financial metric that measures how efficiently a company manages its inventory.
(I) Days Sales Outstanding (DSO)	DSO known as the Average Collection Period, is a financial metric that measures the average number of days it takes for a company to collect payment from its customers after making a sale
(I) Days Payable Outstanding (DPO)	DPO is a financial metric used to measure the average number of days it takes a company to pay its suppliers and vendors for the goods and services it purchases.

3.2

Table 3.2: Definition of inputs/outputs variables

(O) Revenues (REV)	Revenues, also known as sales or turnover, are the income generated by a company from its core business activities.
(O) Net Profit Margin (NPM)	NPM is a financial metric that measures the profitability and efficiency of a company by determining the percentage of each revenue dollar that is converted into net profit.
(O) Return on Assets (ROA)	ROA is a financial ratio that measures a company's profitability in relation to its total assets.
(O) Return on Equity (ROE)	ROE is a financial ratio that measures the profitability of a company in relation to its shareholders' equity. It shows the rate of return earned by the company on the equity invested by its shareholders.
(O) Earnings Per Share (EPS)	EPS is a financial metric that measures the portion of a company's profit allocated to each outstanding share of common stock.
(O) Debt-to-Equity Ratio (DER)	DER is a financial ratio that compares a company's total debt to its total equity. It is used to assess a company's leverage or financial risk.
(O) Current Ratio (CR)	CR is a financial ratio that measures a company's ability to pay its short-term liabilities using its short-term assets. It assesses a company's liquidity and short-term solvency by comparing its current assets to its current liabilities.
(O) Quick Ratio (QR)	QR known as the Acid-Test Ratio or Quick Asset Ratio, is a financial metric used to assess a company's short-term liquidity position.

3.3 Data Envelopment Analysis Model (DEA Model)



3.3.1

DEA Originality

1. An essential aspect of any business operation

2. Analyzing the performance of a business requires consideration of many criteria cause the limited resource, company must face trade off problem

3. Introduce concept of "effective performance margin" or "trade-off curve" represents the best frontier that company can attain due to fixed indicator

3.3.1

An example of DEA

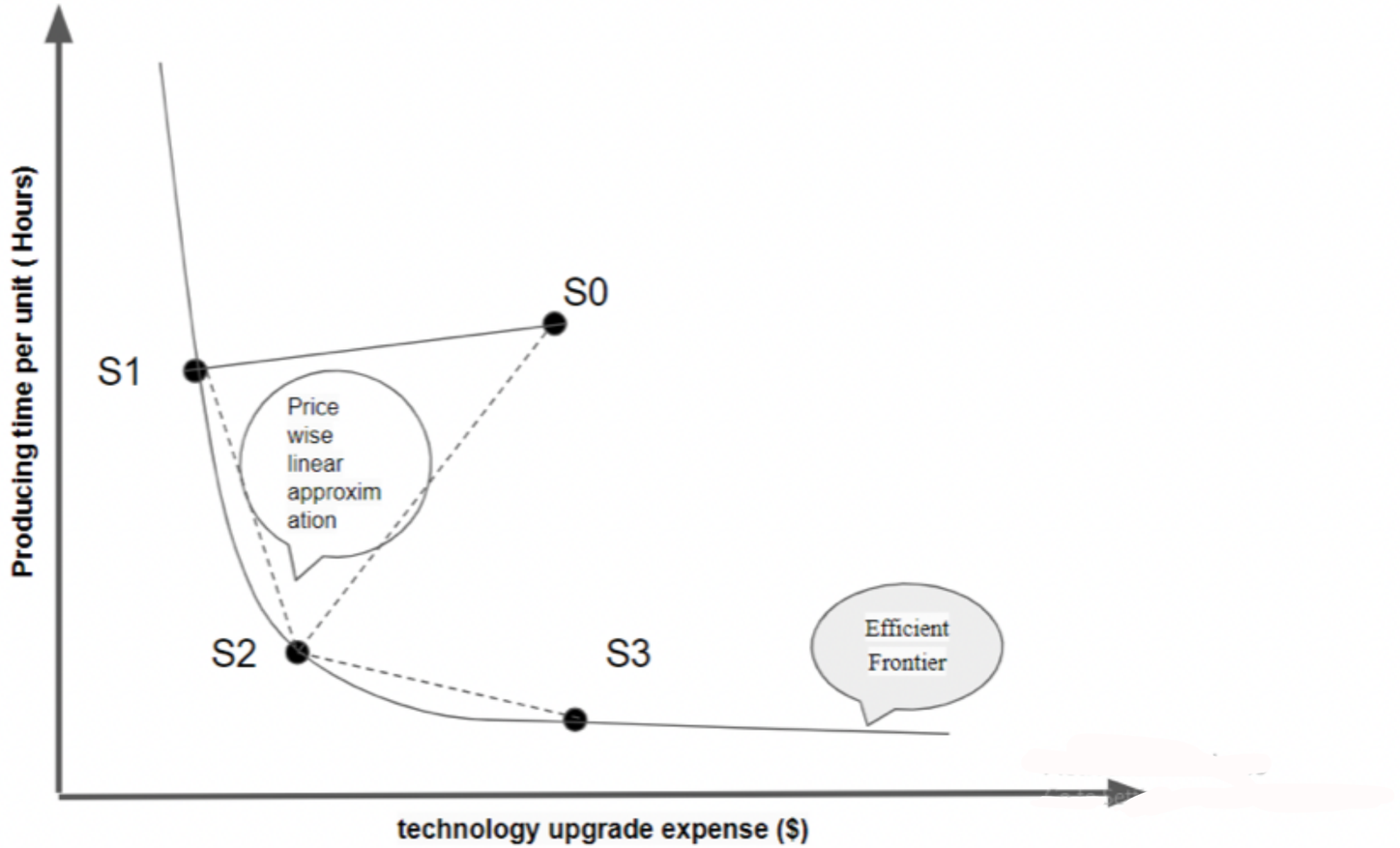


Figure 3.2. (Example) Best efficient frontier of supply chain operations

3.3.2

DEA Super-SBM model

- **The Super-SBM model calculates the efficiency of a DMU by comparing it to the nearest point on the frontier (Slack)**
- **The resulting efficiency value obtained from the model falls within the range of 0 to 1**

In fractional form, the SBM-DEA model evaluates the efficiency of DMU is as follows:

$$\text{Min } \rho = \frac{1-\frac{1}{m}\sum_{h=1}^{m} z_h^- / a_{h0}}{1-\frac{1}{z}\sum_{h=1}^{z} z_h^+ / b_{h0}}$$

$$s.t: \begin{cases} a_0 = A\lambda + z^- \\ b_0 = B\lambda + z^+ \\ \lambda,\ z^-, z^+ \geq 0 \end{cases}$$

DMUs. If ρ ∗ = 1, the Super-SBM model can be described as follows:

$$Min\ \delta = \frac{\frac{1}{m}\sum_{h=1}^{m} \bar{a}_h / a_{h0}}{\frac{1}{z}\sum_{h=1}^{z} \bar{b}_h / b_{h0}}$$

$$\bar{a} \geq \sum_{k=1,\neq 0}^{n} \lambda_k a_k\ , \bar{b} \leq \sum_{k=1,\neq 0}^{n} \lambda_k b_k$$

$$\bar{a} \geq a_0, \bar{b}\ \leq b_0, \bar{b} \geq 0, \lambda \geq 0$$

3.3.3 DEA Resampling Model

Historical (Past-Present Model)

- **Initialization Step:**

> Choose an appropriate DEA model and calculate the Efficiency Scores for the DMUs in the most recent period.
> Select a suitable weighting strategy to balance the available information from the past and present.

$$h_{t+2} = h_t + h_{t+1} (t = 1, \ldots, t, t-2; h_1 = 1,\ h_2 = 2)$$

H represents the total of the series: $H = \sum_{t=1}^{t} h_t$. Then, the weight W_t is as follows:

$$W_t = {}^{h_t}/_{H} \ (t = 1, \ldots, t)$$

- **Iterative Step:**

> The confidence interval is calculated by bootstrapping previous data.
> If the correlation value falls within a specific interval, the resampled data will be deemed acceptable.
> A 95% confidence interval result in the resampled data will ensure the data being closely aligned with the data from the last period but optional

Forecasting (Past - Present - Future Model)

3.4

Forcasting Accuracy

Table 3.3: MAPE value efficiencies in forecasting results

MAPE (%)	Forecast Results
< 10	Highly accurate results
10 - 20	Good results
20 - 50	Reasonable results
> 50	Weak and inaccurate results

CHAPTER 4
FINDINGS AND ANALYSIS

- 4.1.Results of DEA Resampling Model
- 4.2.Analysis before the alliance
- 4.3.Analysis after the alliance
- 4.4.Alliance strategy selection
- 4.5.Discussion

4.1 Results of DEA Resampling Mode

Table 4.1. Correlation Matrix

Input/Output	TL	TE	SG&A	COGS	IT	DSO	DPO	REV	NPM	ROA	ROE	EPS	DER	CR	QR
TL	1	0.947	0.653	0.759	-0.088	-0.107	0.124	0.974	0.079	0.013	0.165	0.118	0.211	-0.211	-0.211
TE	0.947	1	0.482	0.574	-0.204	-0.125	-0.018	0.957	0.236	0.078	0.184	0.189	0.046	-0.117	-0.114
SG&A	0.653	0.482	1	0.949	0.333	-0.050	0.607	0.580	0.102	0.136	0.246	0.131	0.179	-0.016	-0.020
COGS	0.759	0.574	0.949	1	0.250	-0.060	0.495	0.687	-0.019	0.013	0.135	0.049	0.241	-0.112	-0.116
IT	-0.088	-0.204	0.333	0.250	1	0.143	0.523	-0.144	0.016	0.138	0.160	0.359	0.032	-0.087	-0.084
DSO	-0.107	-0.125	-0.050	-0.060	0.143	1	0.325	-0.175	-0.042	-0.186	-0.253	-0.184	-0.340	-0.078	-0.060
DPO	0.124	-0.018	0.607	0.495	0.523	0.325	1	0.061	0.017	-0.016	0.123	0.122	0.275	-0.192	-0.193
REV	0.974	0.957	0.580	0.687	-0.144	-0.175	0.061	1	0.087	0.098	0.250	0.201	0.184	-0.251	-0.253
NPM	0.079	0.236	0.102	-0.019	0.016	-0.042	0.017	0.087	1	0.637	0.578	0.602	-0.436	0.123	0.140
ROA	0.013	0.078	0.136	0.013	0.138	-0.186	-0.016	0.098	0.637	1	0.924	0.765	-0.260	-0.099	-0.093
ROE	0.165	0.184	0.246	0.135	0.160	-0.253	0.123	0.250	0.578	0.924	1	0.829	-0.055	-0.245	-0.243
EPS	0.118	0.189	0.131	0.049	0.359	-0.184	0.122	0.201	0.602	0.765	0.829	1	-0.139	-0.207	-0.199
DER	0.211	0.046	0.179	0.241	0.032	-0.340	0.275	0.184	-0.436	-0.260	-0.055	-0.139	1	-0.547	-0.561
CR	-0.211	-0.117	-0.016	-0.112	-0.087	-0.078	-0.192	-0.251	0.123	-0.099	-0.245	-0.207	-0.547	1	0.999
QR	-0.211	-0.114	-0.020	-0.116	-0.084	-0.060	-0.193	-0.253	0.140	-0.093	-0.243	-0.199	-0.561	0.999	1

4.1 Results of DEA Resampling Mode

Table 4.2. Lower/Upper bounds of 95% confidence for Correlation

	0.8752086	0.3190738	0.4957142	-0.491093	-0.505902	-0.313827	0.9367155	-0.354496	-0.410842	-0.275557	-0.319667	-0.230981	-0.580711	-0.580836
0.978208301		0.0757214	0.2011699	-0.576217	-0.519203	-0.435921	0.8982836	-0.206563	-0.355703	-0.258032	-0.252662	-0.383327	-0.513227	-0.511171
0.842552852	0.7509629		0.8791025	-0.102537	-0.461578	0.2492108	0.2093753	-0.33402	-0.302904	-0.196347	-0.307361	-0.262733	-0.435025	-0.438112
0.894280221	0.8016615	0.9789244		-0.192257	-0.469551	0.0923038	0.373041	-0.437459	-0.410715	-0.30421	-0.380092	-0.200851	-0.509263	-0.512541
0.346792401	0.2378673	0.6620165	0.6072878		-0.296586	0.1304012	-0.533077	-0.408753	-0.300941	-0.280619	-0.073706	-0.3952	-0.490491	-0.488146
0.329338215	0.31316	0.3799308	0.3711872	0.5324235		-0.112344	-0.555838	-0.455458	-0.563319	-0.609771	-0.562206	-0.666222	-0.483495	-0.469655
0.518662792	0.4070823	0.8190302	0.7581545	0.7740852	0.6564061		-0.370198	-0.407937	-0.4348	-0.314877	-0.31554	-0.166029	-0.567548	-0.568144
0.989240246	0.9824164	0.8047016	0.8594521	0.2957529	0.2659528	0.4704443		-0.347656	-0.337116	-0.192282	-0.24125	-0.257949	-0.608574	-0.609516
0.484399581	0.5977985	0.5019782	0.4054956	0.434297	0.3865412	0.4350905	0.4903481		0.2939986	0.2065453	0.2415723	-0.724494	-0.315176	-0.299529
0.432257347	0.483342	0.5274306	0.432382	0.5289884	0.2558026	0.4082365	0.4993635	0.8343338		0.8226144	0.506717	-0.614418	-0.50011	-0.495518
0.548634091	0.561687	0.6045978	0.5263918	0.5447879	0.1884564	0.5178101	0.6072718	0.8036566	0.96829		0.6256821	-0.465536	-0.604265	-0.603026
0.513901165	0.5656066	0.5238742	0.4614298	0.6780271	0.2573243	0.5172711	0.5738148	0.8163367	0.8971847	0.92657		-0.529869	-0.578133	-0.572714
0.58106395	0.4584441	0.5582254	0.601615	0.4473204	0.0950869	0.6241122	0.5617477	-0.017745	0.1812787	0.3756086	0.2998278		-0.787195	-0.794656
0.231485958	0.3204897	0.4080044	0.3252959	0.3474901	0.355528	0.2499832	0.1902913	0.5175669	0.3362339	0.1968517	0.2351557	-0.163246		0.9984546
0.231307142	0.3229879	0.4048207	0.3213242	0.3501981	0.371072	0.2491589	0.1888479	0.5301048	0.3416381	0.198725	0.242794	-0.182577	0.999744	

4.1

Results of DEA Resampling Mode

Table 4.3. Comparisons of 500 and 5000 replicas (2013–2022)

	500 replicas			5000 replicas			Differences	
DMU	**97.50%**	**DEA**	**2.50%**	**97.50%**	**DEA**	**2.50%**	**97.50%**	**2.50%**
DMU1	3.1928	1.6258	1.5376	3.0585	1.6258	1.516	0.1343	0.0216
DMU2	1.833	1.5261	1.1978	1.8392	1.5261	1.1888	-0.0062	0.009
DMU3	4.4843	1.9572	2.0042	4.4545	1.9572	1.9762	0.0298	0.028
DMU4	1.4856	0.684	0.4593	1.4647	0.684	0.4602	0.0209	-0.0009
DMU5	3.2831	1.2728	0.721	3.056	1.2728	0.6223	0.2271	0.0987
DMU6	4.5758	1.465	1.7767	4.3466	1.465	1.7788	0.2292	-0.0021
DMU7	507.4523	0.2965	0.2925	474.9348	0.2965	0.3016	32.5175	-0.0091
DMU8	8.3031	2.2939	1.6847	8.8164	2.2939	1.6809	-0.5133	0.0038
DMU9	4.7086	3.2114	2.439	4.6968	3.2114	2.3344	0.0118	0.1046
DMU10	4.7777	1.0817	0.4127	4.4244	1.0817	0.4272	0.3533	-0.0145
DMU11	3.4215	1.8764	1.6173	3.2531	1.8764	1.6164	0.1684	0.0009
DMU12	2.1346	1.4541	1.0997	2.1215	1.4541	1.0737	0.0131	0.026
DMU13	2.5476	1.3867	1.2711	2.3498	1.3867	1.2445	0.1978	0.0266
DMU14	2.9696	1.1013	0.2972	2.9413	1.1013	0.288	0.0283	0.0092
DMU15	4.4469	1.1645	0.3792	4.3922	1.1645	0.3712	0.0547	0.008
DMU16	68.9755	34.9701	12.3258	69.2567	34.9701	13.2563	-0.2812	-0.9305
DMU17	639.1102	2.0439	0.5937	621.4143	2.0439	0.5035	17.6959	0.0902
DMU18	601.7038	2.3613	1	652.407	2.3613	1	-50.7032	0
DMU19	1.8708	1.1141	0.4298	1.8679	1.1141	0.422	0.0029	0.0078
DMU20	4.0589	0.5552	0.4438	3.687	0.5552	0.4463	0.3719	-0.0025
DMU21	459.8812	1.8995	1	406.5856	1.8995	1	53.2956	0
DMU22	2.8429	1.0374	0.6435	2.7729	1.0374	0.6053	0.07	0.0382

4.1

Results of DEA Resampling Mode

Table 4.4. Forecast scores by the Hybrid model, actual scores, and confidence interval in 2022

DMU	97.50%	Forecast	Actual	2.50%	Forcast-Actual
DMU1	3.1113	1.7681	1.7969	1.505	0.0160
DMU2	1.8656	1.178	1.6132	1.1863	0.2698
DMU3	4.5076	2.9382	2.21559	1.8742	0.3261
DMU4	1.4668	1.0706	0.68399	0.4738	0.5652
DMU5	2.9414	1.0616	1.4177	0.6457	0.2512
DMU6	2.6345	2.0955	3.08413	1.5329	0.3206
DMU7	566.9062	0.5128	0.29654	0.2922	0.7293
DMU8	9.1643	2.5795	2.48385	1.6542	0.0385
DMU9	4.5511	2.4236	3.34549	2.2873	0.2756
DMU10	1.2834	0.4975	2.30528	0.3984	0.7842
DMU11	3.1479	2.0201	2.55986	1.5909	0.2109
DMU12	2.1315	1.2427	1.58755	1.1225	0.2172
DMU13	2.3726	1.3138	1.47086	1.2423	0.1068
DMU14	2.7508	2.4862	1.7391	0.2945	0.4296
DMU15	1.7309	0.4836	1.36481	0.3507	0.6457
DMU16	69.582	16.8135	34.97012	13.4652	0.5192
DMU17	687.0306	0.5311	1	0.4657	0.4689
DMU18	746.9547	1.1675	1	1	0.1675
DMU19	1.8527	0.5144	1.51585	0.3891	0.6607
DMU20	3.2254	0.6078	0.55517	0.4361	0.0948
DMU21	331.8441	1	1	1	0.0000
DMU22	2.7572	2.0252	1.6812	0.727	0.2046
				MAPE	33%

4.3 Analysis before the alliance

Table 4.5. Efficiency and ranking before the strategic alliance

DMU	97.50%	Score	2.50%	Rank
DMU16	69.2567	34.9701	13.2563	1
DMU9	4.6968	3.2114	2.3344	2
DMU18	652.407	2.3613	1	3
DMU8	8.8164	2.2939	1.6809	4
DMU17	621.414	2.0439	0.5035	5
DMU3	4.4545	1.9572	1.9762	6
DMU21	406.586	1.8995	1	7
DMU11	3.2531	1.8764	1.6164	8
DMU1	3.0585	1.6258	1.516	9
DMU2	1.8392	1.5261	1.1888	10
DMU6	4.3466	1.465	1.7788	11
DMU12	2.1215	1.4541	1.0737	12
DMU13	2.3498	1.3867	1.2445	13
DMU5	3.056	1.2728	0.6223	14
DMU15	4.3922	1.1645	0.3712	15
DMU19	1.8679	1.1141	0.422	16
DMU14	2.9413	1.1013	0.288	17
DMU10	4.4244	1.0817	0.4272	18
DMU22	2.7729	1.0374	0.6053	19
DMU4	1.4647	0.684	0.4602	20
DMU20	3.687	0.5552	0.4463	21
DMU7	474.935	0.2965	0.3016	22

4.3

Analysis after the alliance

Table 4.6. Efficiency and ranking after the strategic alliance

Rank	DMU	Score	Rank	DMU	Score
1	DMU16	21.5571	24	DMU7+DMU2	1.02886
2	DMU8	2.52708	25	DMU7+DMU18	0.9907
3	DMU6	2.47288	26	DMU4	0.89512
4	DMU9	2.46754	27	DMU7+DMU3	0.69346
5	DMU3	2.4527	28	DMU7+DMU22	0.68934
6	DMU11	2.16674	29	DMU7+DMU4	0.66922
7	DMU1	1.70384	30	DMU19	0.6101
8	DMU7+DMU21	1.45654	31	DMU20	0.6067
9	DMU22	1.33214	32	DMU17	0.58404
10	DMU7+DMU8	1.26746	33	DMU7+DMU6	0.58396
11	DMU7+DMU16	1.26734	34	DMU7+DMU13	0.55586
12	DMU12	1.26126	35	DMU7+DMU15	0.55108
13	DMU13	1.25492	36	DMU7+DMU17	0.52884
14	DMU21	1.21246	37	DMU7+DMU1	0.51882
15	DMU18	1.15398	38	DMU10	0.51582
16	DMU2	1.13578	39	DMU7+DMU19	0.50248
17	DMU5	1.11504	40	DMU7	0.49878
18	DMU7+DMU12	1.11382	41	DMU15	0.48932
19	DMU7+DMU5	1.08512	42	DMU7+DMU10	0.48136
20	DMU7+DMU14	1.04518	43	DMU7+DMU20	0.43738
21	DMU14	1.04112			
22	DMU7+DMU9	1.0372			
23	DMU7+DMU11	1.03412			

4.3

Analysis after the alliance

Table 4.7. Ranking comparison before and after alliance of potential partners

DMU	The ranking of partner	The ranking of the alliance
DMU7+DMU21	15	8
DMU7+DMU8	2	10
DMU7+DMU16	1	11
DMU7+DMU12	12	18
DMU7+DMU5	17	19
DMU7+DMU14	21	20
DMU7+DMU9	4	22
DMU7+DMU11	6	23
DMU7+DMU2	16	24

4.4

Alliance strategy selection

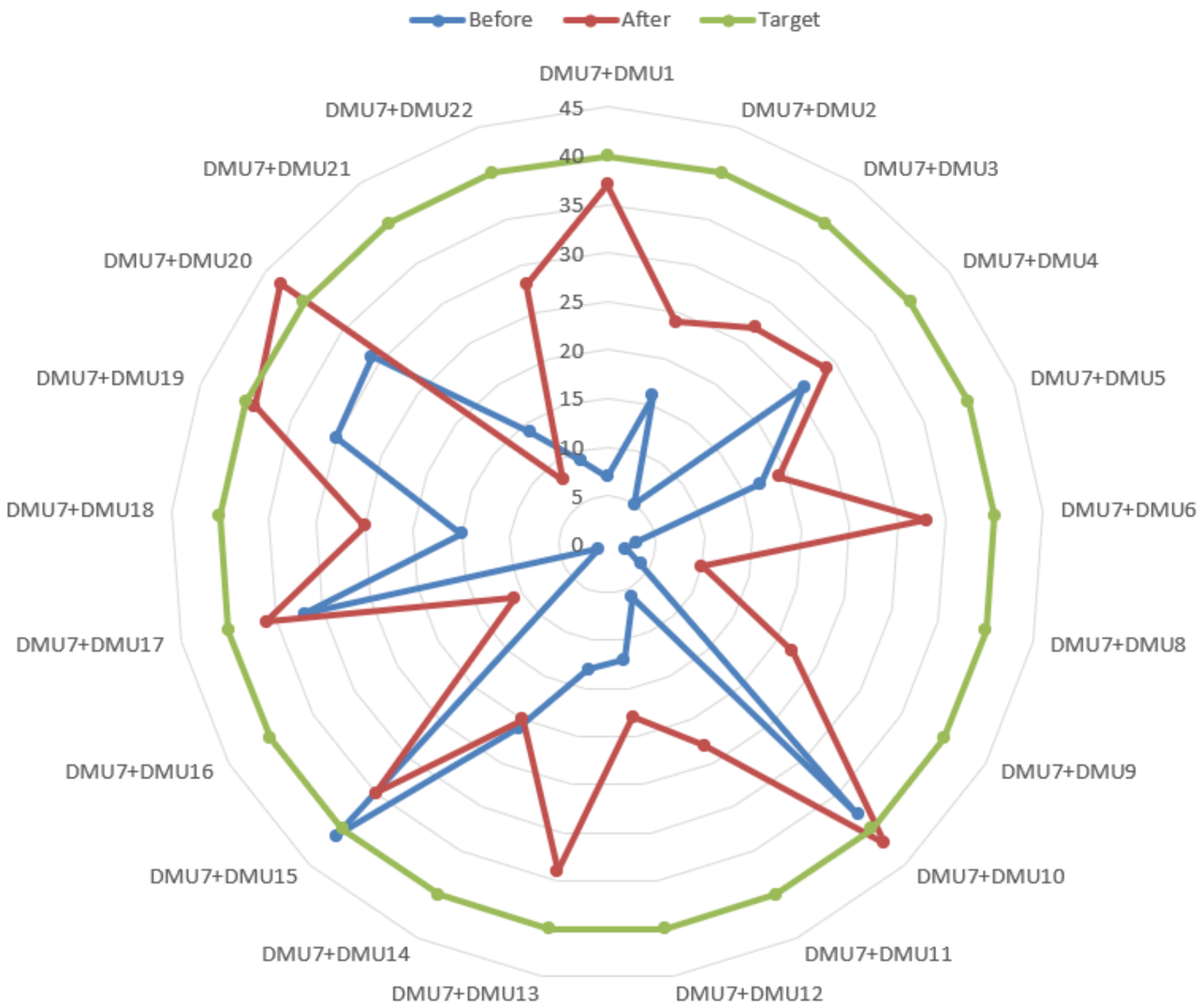


Figure 4.1. The comparison of changes in ranking

4.5

Discussion

This study's findings enrich the existing knowledge on logistics industry alliances by comparing projected outcomes and assessing partnership effectiveness, aligning with previous research in the field:

- This study highlights the significance of strategic alliances in enhancing operational efficiency and performance.
- This study utilizes the Resampling forecasting model, which is a non-parametric approach based on DEA - Super-SBM. This innovative approach adds to the existing literature on forecasting and selecting suitable alliance partners.
- Resampling models have the capability to generate synthetic data, augmenting smaller or less diverse datasets to improve model generalization and reduce overfitting.
- This study considers the perspective of both the target company and partner companies when evaluating alliance effectiveness.
- This study presents valuable findings and aligns with previous research, there may be variations in specific results and outcomes due to differences in methodologies, sample sizes, and other contextual factors.

CHAPTER 5
CONCLUSION

Conclusion

Implications

Limitations and Future Work

5.1 Conclusion

The importance of strategic alliances in the logistics industry.

A 2-stage DEA approach that combines Super-SBM with the Resampling method.

Provide comprehensive information and analysis for selecting an appropriate strategic alliance .

Aiding policymakers and investors in formulating effective development solutions and investment decisions.

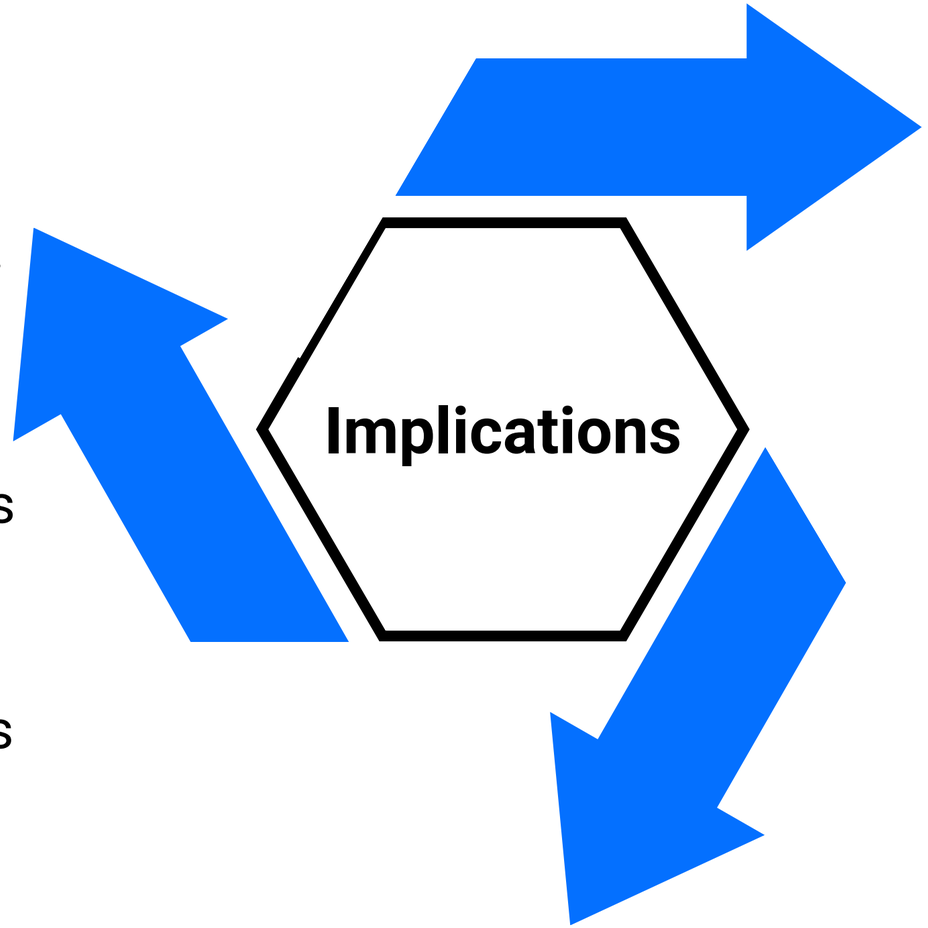
5.2 Implications

Investors

Investors can see the future performance of companies to make important investment decisions.

Policymakers

- Research holds practical significance for policymakers in formulating long-term strategies.
- Assess the benefits and risks in choosing strategic alliances.



Academic

The theoretical implications highlight the significance of strategic alliances as a determining factor in the effectiveness and success of logistics enterprises.

5.3 Limitations and Future Work

Limitations	Future Work
The study focuses solely on logistics companies in Vietnam.	Expanding the scope of analysis to include a larger sample of logistics companies from different countries and regions.
Only use the DEA method to evaluate performance and the Resampling method to forecast future data.	Use techniques to forecast and evaluate performance more accurately and efficiently.
The selection of alliance partners is based solely on quantitative measures derived from financial statements.	Integrating qualitative research methods, such as interviews or case studies.

THANK FOR YOUR LISTENING

Q&A Section