





## **GRADUATION THESIS**

## An integrated DELPHI-DEMATEL-ANP model- based Fuzzy theory for attracting FDI by considering interrelationships among key determinants

### Group 1

Hanoi, April, 2023

## **Research Team**







Tran Linh Chi HS150498

Nguyen Huu Bao Doan Duong Quynh Anh HS150588 HS150649



Tran Thi Nhan HS140503



Ho Thi Phuong Thao HS150299

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#### **Supervisor** Phi - Hung Nguyen Ph.D

## **Published Paper**

Journal of Open Innovation: Technology, Market, and Complexity 9 (2023) 100021



Contents lists available at ScienceDirect

Journal of Open Innovation: Technology, Market, and Complexity

journal homepage: www.sciencedirect.com/journal/joitmc



ELSEVIER

Unlocking the potential of open innovation through understanding the interrelationship among key determinants of FDI attractiveness



Phi-Hung Nguyen\*, Linh-Chi Tran, Huu Bao-Doan Nguyen, Thi Phuong-Thao Ho, Quynh-Anh Duong, Thi-Nhan Tran

Faculty of Business, FPT University, Hanoi 100000, Viet Nam

#### ARTICLE INFO

ABSTRACT

Keywords: FDI Fuzzy theory Fuzzy-Delphi Fuzzy-DEMATEL DANP Vietnam

#### ABSIRACI

Foreign Direct Investment (FDI) plays a critical role in driving economic growth and development, particularly in countries like Vietnam. This study proposes a hybrid model that integrates Fuzzy-Delphi, Fuzzy-DEMATEL, and DANP methods to identify and prioritize the main factors affecting FDI attraction and open innovation in Vietnam. The proposed approach offers a more comprehensive analysis that accounts for the inherent complexities and uncertainties of the FDI decision-making process and its impact on open innovation. By exploring the network and interrelationships between the factors, the study provides a more nuanced understanding of the determinants of FDI attraction, open innovation, and their impact on other factors. The study's results are expected to reveal the critical factors affecting FDI attraction and open innovation in Vietnam and their relative importance, serving as a basis for policymakers to design effective strategies for attracting FDI and promoting open innovation. This can be particularly crucial for developing countries seeking to leverage FDI to drive economic growth and innovation. Additionally, the proposed methodology has the potential to contribute significantly to the literature on FDI attraction and open innovation and provide a valuable framework for future research. Home

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Unlocking the potential of open innovation through understanding the interrelationship among key determinants of FDI attractiveness







## INTRODUCTION

Nguyen Huu Bao Doan & Tran Thi Nhan

1.1. Topic Background

1.4. Research Objectives and Contributions



1.2. Research Gaps

1.3. Research Questions

## 1.1. Topic Background

### Importance Of FDI In The Global Economy

Foreign Direct Investment has been associated with globalization for years. FDI allows MNCs to expand their business operations internationally, aiding the host country's economic development through access to technology, job creation, and labor resource management.

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Attracting FDI has become a crucial development strategy for governments in the post-pandemic era (Ahmad et al., 2020)

## **1.1. Topic Background** Overview Vietnamese FDI Situation

## Heavy industry 1,994 Light industry 1,921

projects **18.2** billion USD



Ministry of Finance (2006)

FDI inflows in Vietnam



International Monetary Fund (2019)

The largest investors included Japan, South Korea, Singapore, Taiwan, and Hong Kong.

## 1.1. Topic Background

**Overview Vietnamese FDI Situation** 

Foreign investors have shown interest in 19 out of the 21 economic sectors in the nation.

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## 1.1. Topic Background

### **Overview Vietnamese FDI Situation**

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Creating jobs in the manufacturing sector, reduced poverty, and improved living standards Facilitating technology and knowledge transfer from advanced economies, promoting industry modernization

Boosting economic growth by increasing exports, diversifying the economy, and developing infrastructure Increasing competitiveness, improving Vietnam's economy's productivity, quality, and efficiency

### 1.2. Research Gaps

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There are gaps in the use of comprehensive research methods that consider the interplay of factors





MCDM models are useful in identifying and prioritizing factors affecting FDI attraction in Vietnam because FDI involves numerous and diverse factors that need to be considered



Several studies have employed MCDM models to identify and rank the critical factors affecting FDI attraction but have not explored the interrelationships between these factors.

### 1.2. Research Gaps

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**Fuzzy-Delphi method**: provides a more nuanced and flexible approach to agreement- structure, allowing for the expression and aggregation of nebulous or disagreeing opinions.

Strength	Useful for decision-making in complex and uncertain situations Allows for corporating subjective judgment and uncertainty in the causal relationships between variables Suitable for real-world decision-making problems
Weakness	Subjectivity Lack of transparency Limited scope

### **1.2. Research Gaps**

**Fuzzy-DEMATEL method**: a decision-making tool that combines fuzzy logic and the DEMATEL method to analyze the causal relationships among factors affecting a problem







What are the critical criteria affecting FDI attraction?

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What are the network and interrelationships among the criteria of FDI attraction?

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What are the priorities of the selected criteria?

## 1.4. Research Objectives and Contributions

#### **Research Objectives**

- ✓ Employing the Fuzzy-Delphi technique to identify crucial factors.
- ✓ Using the Fuzzy-DEMATEL method to identify the relationships between critical factors, providing a comprehensive understanding of the determinants and their influence on other factors.
- ✓ Applying the DANP method to accurately assess the relative importance of the factors based on the results of the Fuzzy-DEMATEL method.

#### **Research Contributions**

- ✓ Improved understanding of FDI determinants
- ✓ Enhanced decision-making for FDI promotion
- ✓ More accurate FDI forecasting
- ✓ Improved competitiveness of host country
- ✓ Enhanced research methodology





## LITERATURE REVIEW

Ho Thi Phuong Thao

2.1. Literature Review On MCDM Models

2.2. Literature Review On Main Dimensions and Key Determinants



2.3. Proposed Model

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**Fuzzy Sets Theory** 

- ✓ Fuzzy Sets Theory is a mathematical framework that deals with uncertainty and vagueness of information, developed by Lotfi A. Zadeh in the 1960s.
- ✓ Since the 1970s, the fuzzy set proposal has been used to categorize geographic realities with vague class descriptions (Chang et al., 2011).
- $\checkmark$  In a fuzzy system, variables can take on values between 0 and 1.

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Delphi And Fuzzy-Delphi Methods

- ✓ The Delphi technique was originally developed by Olaf Helmer et al. in the early 1950s. The opinions are collected from unpacked experts, typically through questionnaires (Galanis, 2018).
- ✓ The Fuzzy-Delphi method uses fuzzy sets to represent the experts' degree of agreement or disagreement. Thus, this process has been completed, and the corresponding anticipated value becomes a casting value if a distance that satisfies a given confluence criterion is set up (Ishikawa et al., 1993).

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**DEMATEL and Fuzzy-DEMATEL methods** 

- ✓ The Battelle Memorial Institute first conducted the DEMATEL method through its Geneva Research Centre in 1973 (Falatoonitoosi et al., 2013). The DEMATEL system utilizes directed graphs, or digraphs, to separate interconnected factors into cause-and-effect groups.
- ✓ The Fuzzy-DEMATEL method handle the vagueness and uncertainty involved in decision-making. The method then uses the alpha-cut technique to transform the fuzzy matrices into crisp matrices, which can be used for further analysis (Herrera et al., 2000).



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ANP and DANP methods

- ✓ The ANP is an extension of the logical scale process AHP (Saaty, 2004) enables the assessment of complex non-interactions among decision situations and attributes.
- ✓ DANP, which combines DEMATEL and ANP, determines the influential weights of criteria based on the Network Relation Map generated by DEMATEL. In this research model, DANP is applied to accurately assess the relative importance of the factor's effect on FDI (Tzeng et al., 2007).



#### **Governmental Dimension**

Governments can either set up policies and regulations that make it easy for foreign investors to conduct business or create an environment encouraging foreign investment.

Main Dimensions	Key Determinants		
	Tax rates and ease of tax payment	G1	
	Efficiency of legal and regulatory processes		
	Transparency of government regulations and lack of corruption		
	Strength of investor and property rights		
Covernment	Government incentives for investors		
Government	Ease of moving capital into and out of the country	G6	
	General security environment	G7	
	Country's participation in regional/bilateral trade agreements	G8	
	Checks and Balances	G9	
	Future orientation of government	G10	



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#### **Market Dimension**

The domestic economic performance of a country is influenced by factors such as inflation, domestic demand, and government policies. Domestic demand determines a country's production, employment, and economic growth level (Dang & Nguyen, 2021).

Main Dimensions	Key Determinants	
	Research and development (R&D) capabilities	M1
	Geographic	M2
	Technological and innovation capabilities	М3
Markot	Population	M4
	Domestic economic performance	M5
	Culture	M6
	Domestic market size	M7
	Trade openness	M8



#### **Resources Dimension**

The charges associated with paying workers for their work. The labor cost is a significant factor in the attractiveness of a region for labor-seeking FDI (Glam & Böke, 2017). The qualifications, training, and capability of workers also impact FDI attraction in both directions.

Main Dimensions	Key Determinants	
	Quality of infrastructure	R1
	Availability of raw materials and other inputs	
Pagauraa	Availability of land/real estate	
Resource	Cost of labor	R4
	Talent/skill level of labor pool	
	Availability of financial capital in domestic market	R6

Key determinants	Definition
G1	Tax rates: The percentage of income or the value of an item that an individual or organization is required to pay to the government as tax Ease of tax payment: the process of paying taxes, including how simple and convenient it is for individuals and organizations to comply with their tax obligations.
G2	The effectiveness and promptness with which legal and regulatory systems operate and deliver results.
G3	The openness and clarity of the rules, processes, and decision-making procedures that govern the actions of government agencies and officials. Lack of corruption: the absence of dishonest or unethical behavior by government officials and employees.
G4	The protection and security that individuals and organizations have in their investments and property.
G5	Various programs and policies designed to encourage investment
G6	The freedom and simplicity of transferring money across international borders.
G7	The overall state of safety and security in a particular area, region, or the world as a whole.
G8	Its active involvement in negotiations and the creation of trade agreements with other countries within a specific region or on a bilateral basis.
G9	A system of regulatory mechanisms put in place by a government to monitor and regulate the flow of foreign investment into the country.
G10	Government's focus on the long-term goals, plans, and strategies that will shape the future of the country.



Key determinants	Definition
M1	The ability of a company, organization, or country to conduct research and develop new products, processes, and technologies.
M2	The location and distribution of investment flows between countries and regions.
M3	The ability of a firm to develop, adopt, and use new technologies and innovations.
M4	The number of people living in a particular geographical area
M5	The level of economic activity, output, and prosperity within a particular country.
M6	The shared beliefs, values, customs, behaviors, and artifacts that characterize a group or society.
M7	The total demand for goods and services within a country's own borders.
M8	The degree to which a country allows goods and services to be traded with other countries.

Key determinants	Definition
R1	The level of development, accessibility, functionality, and reliability of the basic systems and facilities that support a society
R2	The ease with which a company can obtain the necessary resources to produce its goods or services.
R3	The amount of available property that is ready for use or purchase.
R4	The expenses associated with paying employees for the work they perform. This includes their base salary, benefits, and any bonuses or incentives they may receive.
R5	The level of expertise, training, and ability of the workers available for employment in a specific area.
R6	The amount of money that is readily available for investment within a specific country.

## 2.3. Proposed Model

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A hybrid model can identify and prioritize the main factors affecting FDI attraction in Vietnam. The Fuzzy-Delphi method is used to identify the most relevant factors affecting FDI attraction

> The Fuzzy-DEMATEL method is used to assess the interrelationships between the factors

The DANP method is used to prioritize the factors based on their relative importance

The proposed model can assist policymakers in developing effective strategies to attract FDI, particularly in Vietnam.



3.1. Methodology



3.2. Research Methods

3.3. Analysis Procedure



## 3.1. Methodology

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Inductive reasoning approach

Deductive reasoning approach

Abductive reasoning approach



### **3.2. Research Methods**

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Quantitative research

Qualitative research





*Figure 3.3: Proposed research framework* 

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#### **Sample Size**



- ✓ There is no set standard for sample size of a panel but it is generally agreed that the more members will increase the reliability of group judgments.
- ✓ In has been suggested that a minimum number of panel members would range from 10 to 20 panel members per area of expertise.

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#### Fuzzy-Delphi

Linguistic terms (importance)	TFNs
Extreme	(0.75, 1.0, 1.0)
Demonstrated	(0.1, 0.75, 1.0)
Strong	(0.25, 0.5, 0.75)
Moderate	(0, 0.25, 0.5)
Equal	(0, 0, 0.25)

**Table 3.1:** Fuzzy-Delphi linguistic terms transformation



**TFN** membership functions

 $u_{b} = z_{b} - \lambda(z_{b} - y_{b})$   $v_{b} = x_{b} - \lambda(y_{b} - yx_{b})$   $D_{b} = \int (u_{b}, v_{b}) = \lambda[u_{b} + (1 - \lambda)v_{b}]$  (4)  $6 = \sum_{a=1}^{n} \frac{D_{b}}{n}$  (5)

If Db > 6 attribute b is accepted otherwise if Db < 6, attribute b is rejected

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#### **Fuzzy-DEMATEL**



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#### DANP

$$T_{D}^{a} = \begin{bmatrix} t_{D}^{11}/d_{1} \cdots t_{D}^{1j}/d_{1} \cdots t_{D}^{1n}/d_{1} \\ \vdots & \vdots & \vdots \\ t_{D}^{i1}/d_{i} \cdots t_{D}^{ij}/d_{i} \cdots t_{D}^{in}/d_{i} \\ \vdots & \vdots & \vdots \\ t_{D}^{n1}/d_{n} \cdots t_{D}^{nj}/d_{n} \cdots t_{D}^{nn}/d_{n} \end{bmatrix} = \begin{bmatrix} t_{D}^{a11} \cdots t_{D}^{a1j} \cdots t_{D}^{a1n} \\ \vdots & \vdots & \vdots \\ t_{D}^{a11} \cdots t_{D}^{aij} \cdots t_{D}^{ain} \\ \vdots & \vdots & \vdots \\ t_{D}^{a11} \cdots t_{D}^{aij} \cdots t_{D}^{ain} \end{bmatrix}$$
(27)

$$(T_{D}^{a})' = \begin{bmatrix} W^{11} \cdots W^{i1} \cdots W^{n1} \\ \vdots & \vdots & \vdots \\ W^{1j} \cdots W^{ij} \cdots W^{nj} \\ \vdots & \vdots & \vdots \\ W^{1n} \cdots W^{in} \cdots W^{nn} \end{bmatrix}$$

$$W^{a} = T_{D}^{a}W = \begin{bmatrix} t_{D}^{a11} \times W^{11} \cdots t_{D}^{ai1} \times W^{i1} \cdots t_{D}^{an1} \times W^{n1} \\ \vdots & \vdots & \vdots \\ t_{D}^{a1j} \times W^{1j} \cdots t_{D}^{aij} \times W^{ij} \cdots t_{D}^{a11} \times W^{nj} \\ \vdots & \vdots & \vdots \\ t_{D}^{a1n} \times W^{1n} \cdots t_{D}^{ain} \times W^{in} \cdots t_{D}^{ann} \times W^{nn} \end{bmatrix}$$

$$(28)$$

$$(29)$$

 $\lim (W^a)^z$ 

(30)

 $z \to \infty$ 





## DATA ANALYSIS AND RESULTS

Tran Linh Chi

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4.1. Result Of The Fuzzy-Delphi Method

4.2. Result Of The Fuzzy-DEMATEL Method

4.3. Result Of The DANP Method

## 4.1. Result Of The Fuzzy-Delphi Method



	Criteria	u	V	Db	Validate	Ranking
1	G1	0.910	-0.057	0.441	Accept	1
	G2	0.786	0.036	0.402	Accept	17
	G3	0.859	-0.019	0.425	Accept	4
	G4	0.847	-0.010	0.421	Accept	5
	G5	0.834	-0.001	0.417	Accept	6
	G6	0.798	0.027	0.405	Accept	11
-	G7	0.792	0.031	0.404	Accept	15
	G8	0.796	0.028	0.405	Accept	13
	G9	0.647	-0.147	0.287	Reject	22
1	G10	0.647	-0.147	0.287	Reject	23
	M1	0.804	0.022	0.407	Accept	9
	M2	0.874	-0.030	0.429	Accept	3
	M3	0.804	0.022	0.407	Accept	9
	M4	0.786	0.036	0.402	Accept	17
	M5	0.798	0.027	0.405	Accept	11
-	M6	0.794	0.029	0.404	Accept	14
57	M7	0.789	0.033	0.403	Accept	16
	M8	0.635	-0.135	0.284	Reject	24
	R1	0.780	0.040	0.400	Accept	21
	R2	0.814	0.014	0.411	Accept	7
	R3	0.806	0.020	0.408	Accept	8
	R4	0.898	-0.049	0.437	Accept	2
	R5	0.783	0.038	0.401	Accept	19
	R6	0.783	0.038	0.401	Accept	19
			Threshold	1: 0.396		-

#### Table 4.6: Fuzzy-Delphi Method Result

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4.2. Result Of The Fuzzy-DEMATEL Method





*Figure 4.9: Cause-and-effect relationships among variables* 





### 4.2. Result Of The Fuzzy-DEMATEL : Method





*Figure 4.10: Cause-and-effect relationships among variables* 

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### 4.3. Result Of The DANP Method



	Criteria	weight	Rank
G1	Tax rates and ease of tax payment	0.040	21
G2	The efficiency of legal and regulatory processes	0.042	17
G3	Transparency of government regulations and lack of corruption	0.042	16
G4	Strength of investor and property rights	0.041	20
G5	Government incentives for investors	0.043	14
G6	Ease of moving capital into and out of the country	0.042	18
G7	General security environment	0.042	15
G8	Country's participation in regional/bilateral trade agreements	0.041	19
M1	Research and development (R&D) capabilities	0.048	9
M2	Geographic	0.047	10
M3	Technological and innovation capabilities	0.047	12
M4	Population	0.05	7
M5	Domestic economic performance	0.047	11
M6	Culture	0.049	8
M7	Domestic market size	0.046	13
R1	Quality of infrastructure	0.056	2
R2	Availability of raw materials and other inputs	0.055	5
R3	Availability of land/real estate	0.056	4
R4	Cost of labor	0.057	1
R5	Talent/skill level of the labor pool	0.056	3
R6	Availability of financial capital in the domestic market	0.055	6

 Table 4.10:
 Ranking of criteria





## DISCUSSION AND CONCLUSION

Duong Quynh Anh

5.1. Comparison of Research Results5.2. Research Implications5.3. Limitations5.4. Future Research





## 5.2. Research Implications



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Theoretical implication



## 5.2. Research Implications

Managerial implication

Policymakers can design policies and incentives that focus on the most influential factors



Investors and business managers can benefit from the study by prioritizing these key determinants

Compliancing with government regulations is highlighted as critical for investors and business managers Home P

## 5.3. Limitations

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differences in FDI attraction factors in other regions or countries

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## 5.4 Future Research

Identify the strengths and weaknesses of different methods and generate more  $\square$ reliable and robust findings \*\*\*\*\*\*\*\* Utilizing a mixed methods  $\mathbf{Q}_{\mathbf{a}}^{\mathbf{a}}$ approach that combines both qualitative and quantitative methods to scrutinize the factors that impact FDI attraction Utilizing machine learning **.**... method

Investigating the dynamic nature of FDI attraction and how changes in investor preferences, global economic conditions, and technological advancements affect the relative importance of different factors over time

Investigating the factors that impact FDI attraction in different regions or countries



# THANK YOU for your attention



Hanoi, April, 2023