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Study on Influencing Factors of Port Logistics Development Based on Configuration Analysis QCA*

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Abstract

Purpose – In the context of economic globalization and the continuous development of international trade, as countries around the sea peninsula, port construction is particularly important. Based on the research on the influencing factors of port logistics development based on the allocation analysis, QCA (Qualitative Comparative Analysis) provides the basis for the planning and policy of port logistics development and has important theoretical value and practical significance for improving the level of port logistics management, reducing logistics operating costs and increasing economic benefits. In the tide of global integration for the development of port logistics, promote the growth of foreign trade economy of the city. It is also of great significance to the development and progress of commerce and trade.

Design/methodology – Based on the relevant data samples of various ports in South Korea, this paper uses fsQCA (fuzzy set Qualitative Comparative Analysis) to integrate and analyze the influence mechanism of port logistics development and extracts five influencing factors of port logistics development, including the port's scale and infrastructure in the hard environment, port-neighboring enterprises in the soft environment, hinterland economy and government support.

Findings – The five factors are unable to separately constitute the necessary and sufficient conditions of port logistics development, only a combined model can influence lake port logistics development. The scale and infrastructure of the port itself and port-neighboring ring enterprises are the main core conditions, which work together on the port, affect the throughput capacity of the port, and promote the development of port logistics. When the port-neighboring enterprises are not complete and the scale is low, the growth of port throughput will be restrained and the development of port logistics will be affected, whether the hinterland economic benefits are general, the development of port-neighboring enterprises is insufficient, or the government supports are limited.

Originality/value – Through the research on the development of port logistics in South Korea from the perspective of configuration, this paper finds the configuration influence of hard environment and soft environment on the development of port logistics, which has important theoretical and practical significance for better promoting the development of port logistics in South Korea.

Keywords: Port Logistics, fsQCA, Configuration Analysis, Hard Environment, Soft Environment
JEL Classifications: F14, F40, O53

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1. Introduction

Global economic integration, the integration of production, trade integration leads people into a new round of competition, talent, capital, information, material flows rapidly in global integration, the various countries and regions are nervous to explore how to better implement "global standards and local action" in the process of "globalization." A perfect modern logistics system plays an important role in this process. As the hub of land and water transportation and logistics, the port plays an important role in the development of modern logistics by its innate natural conditions and superior geographical position. The development of port logistics has become the driving force for the growth of foreign trade and the economic growth of a port and its city.

The development of ports has a long history. In the early stage, port development only focused on ship docking, loading, unloading, transshipment, storage, etc. The improvement of port infrastructure and ship carrying capacity directly affected the operation efficiency and comprehensive competitiveness of port logistics. With the diversification of port functions, the influencing factors of port logistics efficiency have also become diversified. Clyde Kenneth Walter and Richard Post (2004) argue that landlocked countries need to refocus their attention on their transport infrastructure by studying changes in US transport policy and the volume of freight resulting from the North American Free Trade Area (NAFTA). Cesar Dukrui and Martien Vanderhorst (2009) argue that there is a significant interdependence between transport integration and port performance, but this is mainly affected by factors such as hinterland, accessibility, and regional sequelae. Liu Mingming (2019) believes that port development presents diversified demands for talents, and strategic talent reserve is the intellectual guarantee for the rapid development of ports. High-level logistics talents have forward-looking thinking and grasp the basic characteristics of the industry development model. They can provide reasonable suggestions for the development of the port logistics industry from a strategic perspective and accurately grasp its pulse. Xu Wei and Gong Xiaohan (2019) improved the traditional grey relational degree model and further analyzed and studied the synergy between the two by using the multi-dimensional grey GM (1, N) model, focusing on the quantitative analysis of the impact of the hinterland economy on the development of port logistics. Jiang Tingting and Zhang Deyin (2020) believe that port logistics is a comprehensive logistics system in a special form and an irreplaceable important node of modern logistics activities. It takes the basic logistics services and derived value-added services in the logistics system of the whole supply chain as its responsibility. Therefore, in the whole supply chain logistics network system, the future development of port logistics is particularly important. Its development not only affects the circulation and turnover of materials inside and outside the port but also has great significance for the development of the hinterland economy and the stability of the whole logistics supply chain. Wang Bing and Wu Chu (2020) believe that port trade facilitation makes the communication between countries faster and more efficient, and is the premise and guarantee for creating new economic growth points. Therefore, it is of great practical significance to study the influencing factors of the development of port logistics.

In sum, this paper will be based on relevant data samples of South Korea's ports, combine the advantages of qualitative and quantitative analysis of the respective QCA method to study the influence factors of port logistics development, explore the causal complexity behind the port logistics development, based on the configuration effect analysis of the influential factors of logistics development, proposes a solution for more applicability and operability.

2. Literature Review

Port logistics refers to the development of a comprehensive port service system covering all links of the port-neighboring enterprises' chain by taking advantage of its port advantages and relying on advanced hardware and software conditions, strengthening its radiation to surrounding ports and economic hinterland, highlighting the port in the collection of goods, inventory, distribution advantages, basing itself on port-neighboring industries, supporting by information technology and aiming at the optimization and integration of port resources. Port logistics can play a variety of roles in the supply chain, not limited to the traditional simple cargo transfer point role. (2008, John Mangan and Chandra Lalwani). The main elements of port logistics include fluid, flow direction, and carrier. Among them, fluid refers to the transport volume of port goods. Port logistics can be regarded as the flow process of goods between buyers and sellers, during which the port undertakes the tasks of storage and transit and is in the state of transport and flow. Flow direction refers to the flow direction of goods in the port, including the actual flow direction of goods and the designated flow direction of goods. The carrier is the facilities and equipment necessary to carry out port logistics business, including port infrastructure and equipment used for cargo loading and transportation (2020, Jiang Tingting and Zhang Deyin). Based on the research of domestic and foreign scholars on port logistics, this paper divides the factors affecting the development of port logistics into the following two levels.

First, the hard environment, mainly including the port infrastructure conditions and scale. The infrastructure of port logistics refers to the facilities that must be provided to complete the most basic functions of port logistics, including loading, and unloading facilities and equipment, warehouses, etc. The quantity and advanced degree of loading and unloading facilities directly affect the loading and unloading capacity, and then affect the turnover speed of port logistics; The size and space rationality of the warehouse yard directly affect the efficiency of port logistics operation.

The number of ships that can dock at a port for loading and unloading operations at the same time, namely, the number of berths at a port, is the main scale indicator of a port. The scale of other facilities should generally be matched with or coordinated with the number of berths at a port. Determining the number of berths at a port is the main content of the study on the size of a port (2020, Lu Ziai). Port geography condition is also one of the important factors that influence port scale, even if the port modernization level is very high, can significantly improve the efficiency of the port of loading and unloading of goods, shorten the time of the goods and the ship stay in port, reduce the cost of the goods in port but compared with the ports with geographical advantages, the loading and unloading of goods in the inner port require longer inland transportation, inland transportation costs tend to be offset by even more than the goods at the port of less pay port charges, so big port often appear in the coastal areas (2007, Zhang Qiang).

The second topic is the soft environment. Port development cannot be separated from the hard environment such as infrastructure, and even from the breeding and support of the soft environment. The soft environment is not only the external condition of port development but also has decisive significance for promoting port development in a certain sense. Today, most countries face efficiency challenges arising from inland connectivity, coupled with growing green concerns, which necessitates the integration of the port-hinterland logistics with economic objectives (2018, Qian Dai, Yang Jiaqi, Dong Li).

The development scale and development vigor of the economic hinterland is the important guarantee of port development. When economically developed hinterland of degree increases, the port cargo throughput and container throughput will increase; it not only makes the port

scale bigger and puts forward further requirements on the port, but the port continuously promotes development when ports continuously develop and expand, and will improve the economic hinterland of the foreign trade development level and the economic hinterland of increasingly powerful (2020, Zhang Keyi). At the same time, with increased security and an increasing emphasis on flexible and efficient logistics, ports must become high-tech logistics hubs, and real-time data on port throughput must be improved (2012, Roger E.HAMLIN). Through to the main economic indicators of trends in the processing and comprehensive, from production, investment, consumption, employment, financial, trade, and other economic indicators are selected after the main economic indicators reflect sensitivity, month-on-month increase or decrease rate of these indicators is called a weighted average of the establishment of index comprehensive climate index, referred to as CI (Composite index). The comprehensive prosperity index can well reflect the economic development status or dynamics of a region. It is formulated and published by the Statistics Department of South Korea every month. According to the degree of consistency of individual constituent indicators to the economic transition point, it can be divided into leading composite index (Leading), peer composite index (CoIncident), and lagging composite index (Lagging). Leading comprehensive index is the index to predict the future diffusion, integrated manufacturing entrant's ratio, business climate reality check index (Performance), pure commodity trading terms, building permits area, capital imports again, the equipment investment prediction index, the inventory cycle index, total liquidity, monthly average Kospi index on the index trend of future economic activities have a huge impact after making. The comprehensive index of the same trade includes the number of non-peasant households employed, the industrial production index, the manufacturing utilization rate index, the wholesale and retail sales index, the built-up value of construction, the export value, and the import value, etc., which are indicators reflecting the current economic situation and essentially same as the overall economic fluctuation. The backward comprehensive index is the index to confirm the boom change, which is the number of job-hopping, the number of commonly used labor, urban consumption expenditure, the import amount of consumer goods, consumer goods import amount, import amount, etc.

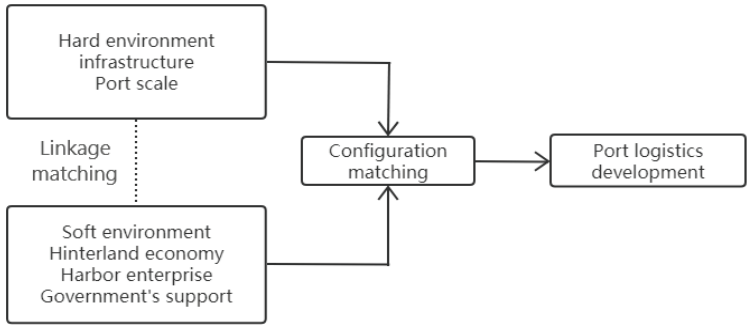
The port-fronting logistics industry, which is composed of enterprises engaged in port-related business in the same port area, is also of great significance to the development of the port. The port-neighboring logistics industry is based on the port industry and commerce, relying on the port resources, gathering the various functions of the global supply chain network at the port nodes, and laying a foundation for the optimization of the port logistics function and the development of the economy. Port-neighboring logistics industry is a part of the inland economy, and part of the Marine economy, so have the characteristics of the inland economy and at the same time, the generality of the Marine economy and inland economy and Marine economy combining site, port-neighboring logistics industry relying on the port resources, but is not limited to the port area, with regional characteristics and space radiation ability (2014, Peng Beijing peace Zhang Yunhe), It has its own particularity. The development of the Marine transportation industry gives birth to the port-neighboring logistics industry, and its development is inseparable from the Marine transportation equipment and the infrastructure required by the inland logistics industry (Duan Xiaoyu, 2020). Hyuk-Soo (2015) proposes that liner transport connectivity and volume per unit connection are positively correlated with the performance of container ports, while trade costs and trade-related infrastructure mitigate this relationship.

For the development of port logistics, the government also plays an important role, and the play of government functions has played a positive role in promoting the development of port logistics. S Lee and J Cho (2017) believe that the government decides the number of ports.

The government not only plays an important guiding role in port planning but also plays an important role in optimizing the business scope and management mode of port logistics (Ding Xue, 2020). While providing policy guidance for port and logistics development, the government needs to constantly improve the function of port logistics development and amplify the advantages of port logistics development (2019, Sun Jingchao)

The existing research mainly analyzes the development of port logistics from one of the two different aspects of the soft environment or hard environment, using qualitative or quantitative analysis methods. In this paper, based on the relevant academic research, from the infrastructure, the port scale, hinterland economy, enterprise, government support to measure the development of the hard and soft environment, adopt the method of QCA of port logistics under the dynamic combination of the hard and soft environment the influence factors of development, using "configuration perspective", the empirical finding could lead to the multiple factors for the development of port logistics, comprehensive analysis of the role of infrastructure, port scale, hinterland economy, port enterprises, and government intervention, and try to find out which combination of factors play a more important role in it. The theoretical framework model of this paper is shown in Fig. 1.

Fig. 1. Theoretical Framework Model



3. Study Design

3.1. Overview of Research Methods

Qualitative Comparative Analysis (QCA), first proposed by sociologist Ragin in 1987, is a case-oriented analysis method, in which the use of QCA refers to specific information about the case and can examine the core combination of antecedents in the case. "Multiple concurrent causalities" is equivalent. The QCA method breaks some of the core assumptions in the mainstream statistical methods. By relaxing some assumptions, the QCA method expands the analysis framework of causality. In recent years, the application of QCA has gradually expanded, especially in the field of management where the nature of research problems is "result-driven" and "configuration" (2017, Du Yunzhou, Jia Liangding).

The qualitative comparative analysis method is a research method based on Boolean algebra with set theory as the core operation logic. The most basic logic of Boolean algebra is the dichotomy of 1 or 0, which represents whether a variable appears, where 1 represents the presence of the variable and 0 represents the absence of the variable. QCA mainly includes traditional clear set Qualitative Comparative analysis, (csQCA), multi-value Qualitative

Comparative analysis, (mvQCA), and Fuzzy Set Qualitative Comparative Anals-YSIS (fsQCA). Among them, the clear set qualitative comparative analysis (csQCA) is a binary division of variables directly into 1 or 0, and there is a clear correspondence between the results and the conditional organization. In the qualitative comparative analysis of fuzzy sets (fsQCA), variables cannot be categorically divided and are in a fuzzy state between 0 and 1. By introducing the concept of "membership degree", three thresholds of 0.05, 0.5, and 0.95 are generally set. On this basis, according to the difference between the condition variable and the ideal state, the membership value is calculated. Qualitative comparative analysis of multi-valued sets (mvQCA). It is a further extension based on a clear set. Assignment to variables is not limited to 0 and 1 but is further extended to 0, 1, 2, or more values, like the processing of categorical variables in quantitative analysis. Compared with csQCA and MVQ-CA, qualitative comparative analysis of fuzzy sets (fsQCA) is used in a more mathematical form, that is, fsQCA can deal with the partial membership problem of sets.

At the same time, the method preserves core set theory principles such as subset relations, which are the core of analyzing causal complexity. These set operations are beyond the scope of traditional variable-oriented analysis. In fuzzy sets, consistency calculation takes membership into account, so cases that are defined as consistent in a clear set or multivalued set analysis may be defined as inconsistent in fuzzy set analysis. Consistent fuzzy set evaluation is not only more rigorous but also has a wider range of evaluation. In the fuzzy set, each row represents a different combination of conditions, and each case has a partial membership degree in each row of the truth table. Therefore, the consistency evaluation of each row as a sufficient condition involves all the cases in the analysis, and the evaluation focuses on the extent to which the resulting membership degree of the case and the drawing of a combination membership degree for the upper triangle model. Using fuzzy sets researchers can perform a more accurate and rigorous set theory consistency assessment than clear set and multi-valued set analysis. In fsQCA, each combination of conditions is evaluated based on the pattern presented by all cases, rather than a small subset of cases (such as csQCA and mvQCA). Compared with mvQCA, the use of fuzzy sets does not exacerbate the "finite diversity" problem. Therefore, fsQCA has been widely recognized by scholars.

The content of this study also has the following three characteristics: First, the sample size is small. At present, the port data and statistics related to port throughput in China are limited. Based on the qualitative comparative analysis of research characteristics of small and medium-sized sample sizes, this paper adopts this analysis method. Second, the current port development in China is diversified, and its influencing factors are multiple and concurrent in the specific operation process, and it is the advantage of FS QCA to explore the diversified combination of conditions. Thirdly, the explanatory variables studied in this paper are not of either-or type, but vary within a certain level. In sum, a fuzzy qualitative comparative analysis is more suitable for the research method in this paper.

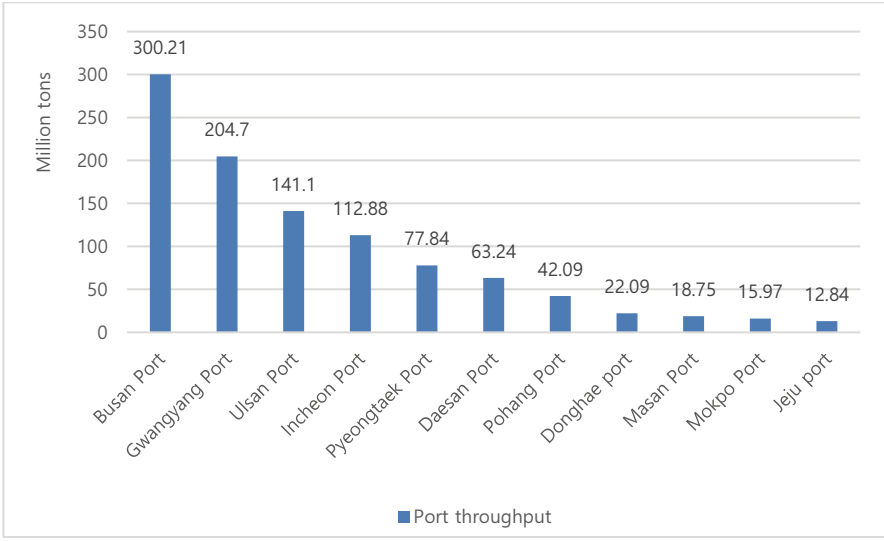
3.2. Case and Variable Description

3.2.1. Case Selection

QCA is a case-oriented research method, which follows the principle of theoretical sampling rather than random sampling. There are two considerations for case selection: 1) similarity. Selected cases should fully share common backgrounds or characteristics; 2) Diversity. The core criterion is to maximize inter-case heterogeneity. Based on the above QCA principle of case selection for small and medium-sized samples and considering the availability of data, This paper selects 11 representative ports in South Korea that meet the conditions: Busan Port, Gwangyang Port, Ulsan Port, Incheon Port, Daesan Port, Pohang

Port, Kunsan Port (renamed as Pyeongtaek Port), Masan Port, Mokpo Port, Donghae Port and Jeju Port as the case samples. The throughput of selected ports ranks high, and most of them take the national managed ports as the object, and the research mainly takes the national managed ports as the research object. According to the statistics of the department, in recent years, the cargo throughput of the 11 ports is at the forefront of the import and export ports of the same kind of cargo in the country. Among them, from January to October in 2020, the cargo throughput of Busan Port is 300.21 million tons, while the cargo throughput of Jeju Port is 12.84 million tons. This mainly comes from the information and data published by the Korea National Statistics Portal (KOSIS), the Korea Port Logistics Association, and the harbor communes of various ports (as shown in Fig. 2.).

Fig. 2. Cargo Throughput of Major Ports from January to September in 2020



Source: Information and data published by the Korea National Statistics Portal (KOSIS), the Korea Port Logistics Association, and the Harbour Communities of the various ports.

3.2.2. Variable Selection

In conditional selection, we need to consider the reason of conditional selection and the number for conditional selections. Rihoux et al. (2009) took the lead in carrying out directional guidance and believed that the selection of conditions was mainly based on theoretical and empirical knowledge. On this basis, Zhang Ming et al. (2019) summarized five methods: problem-oriented method, research framework method, theoretical perspective method, literature induction method, and phenomenon summary method, and believed that these five methods were complementary and could be comprehensively applied in specific research. On the number of conditions: a good balance must be struck between the number of cases and the number of conditions. In a medium sample analysis of 10-40 cases, 4-7 antecedent conditions are usually selected. The selection of conditions in this paper is based on the combination of the research framework method and literature induction method. Starting from the research framework, appropriate conditions are summarized from the existing relevant literature and a mixed conditional combination library is derived. Therefore,

infrastructure, port scale, hinterland economy, port-neighboring enterprises, and government support are selected as the conditional variables, and port throughput is selected as the outcome variable.

3.2.2.1. Outcome Variable

Port throughput is the most important index to measure the size of a port. Reflected in certain technical equipment and labor organization conditions, a certain number of ports for the loading and unloading of goods. The port throughput can report the amount of cargo entering and leaving the port area by water and loading and unloading during the period. Port throughput is an important index to measure the development of port logistics, which can reflect the scale and capacity of the port. Therefore, this paper selects the throughput of 11 South Korean ports from January to September 2020 as the result variable with a period of 9 months.

3.2.2.2. Conditional Variable

Due to excessive conditions, variables can lead to generating far beyond the total condition combination sample, cannot reflect the real situation, so in this paper, based on existing literature research and consider the data integrity and continuity, etc., from the existing literature classification analysis related indicators, ultimately selected port infrastructure, locates scale and hinterland economy, enterprise, government intervention, as a condition variable. The specific measurement method of each variable is as follows:

Port infrastructure. Infrastructure conditions are mainly determined by loading and unloading equipment and yard size. Loading and unloading equipment is the main infrastructure in port production and operation. The quantity and advanced degree of loading and unloading equipment are important factors to determine loading and unloading capacity. A more comprehensive measure of infrastructure conditions is therefore obtained by weighting the loading and unloading capacity (50%) and yard area (50%).

Port scale. Generally speaking, the larger the port scale, the greater the development potential of port logistics. It is found that the port size is mainly affected by the length of the shore wall and the number of berths. Therefore, the quayside length (50%) and the number of berths (50%) are calculated by weighting.

Hinterland economy. The climate composite index can reflect the economic development of the port city more comprehensively. Index month-to-month increase means boom, decline means a decline. It can not only analyze the direction, situation, and turning point of the boom change, but also analyze the change speed at the same time, so it is widely used in South Korea. A comprehensive prosperity index is divided into a leading comprehensive index, peer comprehensive index, lagging comprehensive index. Because this paper studies the influencing factors of port logistics development through the logistics data in the past, this paper adopts the peer comprehensive index to measure the development of the hinterland economy.

Port-neighboring enterprises. The development of port logistics cannot be separated from the development of port-neighboring enterprises, which are complementary and inseparable. Therefore, the development status of port-neighboring enterprises is calculated by weighted calculation of total profit (40%), the number of enterprises (30%), and the number of employees (30%).

Government support. Because the port has the characteristics of quasi-public goods, quasi-business, and social welfare, the government guides and supervises the development of the port, which is the continuation of the government's economic function. The level of government support depends on how much the government spends on ports. Therefore, the budget

invested by the government in the port / the total budget of the port city is used to measure the degree of government support.

3.2.2.3. Variable Calibration

In this study, the variables are calibrated into fuzzy sets by the direct method. Because in this paper, the author studies on the port of the hard and soft environment do not have a unified standard of measurement, lack of external and theoretical criteria, refer to previous studies, this article will result in variable port handling capacity (PHC), condition variables, port infrastructure (PI), port scale (PS) and hinterland economy (using climate composite index as an indicator, CCI), port enterprise (PE), government support (GS) of full membership, intersection and not set the three calibration points respectively as sample descriptive statistics of the upper quartile (75%), the median (50%) and lower quartile (25%).

Table 1 is the descriptive statistics of all variables in the sample and the fuzzy set calibration anchor points. It can be seen from the table that the average port throughput is 92.155, the standard deviation is 92.014, and there is a large difference between the minimum value of 12.836 and the maximum value of 300.210. This shows that the handling capacity of South Korea's major ports is uneven and the development of port logistics is not balanced. The standard deviation of the hinterland economy and government support is relatively small, but the standard deviation of all conditional variables is generally large, especially the infrastructure, which standard deviation is 51.141. This shows that the soft and hard environments of South Korea's ports are not equal, especially the difference in infrastructure. This is also a universal phenomenon in the port development of all countries in the world.

Table 1. Collection, Calibration and Descriptive Analysis

Collection	Fuzzy set calibration			Descriptive analysis			
	Completely Unaffiliated	Inter-section	Complete Subordination	The Mean	Standard Deviation	Minimum Value	Maximum Value
Port Handling Capacity (PHC)	17.5	70.4	225.9	92.155	92.014	12.8	300.2
Port Infrastructure(PI)	9.7	14.9	72.1	44.903	51.141	1.4	178.3
Port Scale (PS)	16.4	23.4	68.3	38.580	26.842	11.8	84.1
Hinterland Economy (CCI)	93.3	99.2	107.4	99.182	6.043	93	109
Port Enterprise (PE)	31.3	60.5	86.2	81.814	93.343	7.3	357.4
Government's Support(GS)	0.042	0.266	0.62	0.266	0.167	0.04	0.67

4. Data Analysis and Empirical Results

4.1. Necessary Condition Analysis

In the qualitative comparative analysis of fuzzy sets (FS QCA), if there is a certain antecedent condition in the configuration matched by the occurrence of interpreted results,

the condition will be identified as a necessary condition for interpreted results (Ragin, 2008). The necessary condition analysis must be carried out before the program analysis of the fuzzy set truth table. In fuzzy set analysis, a necessary condition exists when the result instance constitutes a subset of the conditional instance. Because truth table analysis is essentially sufficiency analysis. The condition identified in this way will be discussed as a necessary condition, and its relevance with any combination of sufficient conditions resulting from the truth table analysis should be considered.

In the analysis of Necessary Conditions for the qualitative comparative analysis of fuzzy sets (FS QCA), Consistency can indicate to what extent it satisfies that the result variable is a subset of the condition variable. If there is a Consistency value of an antecedent condition greater than 0.9, Is considered as a necessary condition (Zhang Ming et al., 2019). Meanwhile, if a single variable is a sufficient condition for the result to change, then the fuzzy set score value of the single variable should be less than or equal to the fuzzy set score value of the result variable, and the consistency index should be greater than 0.8 (Cheng Cong and Jia Liangding, 2016). As can be seen from Table 3, the necessity of each single condition variable affecting the development of port logistics does not exceed 0.9, which does not constitute a necessary condition. This shows that the explanatory power of the single conditional variable to the result variable is insufficient, and also shows the complexity of the port logistics. Therefore, the following conditional configuration analysis is carried out to find out the condition configuration with the greatest strength to explain the case, and the impact of hard environment and soft environment on port logistics is analyzed at the same time.

Table 2. Essential condition test

Conditional variable	PHC		~PHC	
	Consistency	Coverage	Consistency	Coverage
PI	0.801	0.758	0.353	0.347
~PI	0.310	0.315	0.754	0.798
PS	0.748	0.769	0.335	0.359
~PS	0.377	0.352	0.784	0.764
CCI	0.531	0.593	0.472	0.550
~CCI	0.597	0.521	0.651	0.591
PE	0.698	0.733	0.342	0.374
~PE	0.404	0.371	0.756	0.722
GS	0.694	0.914	0.392	0.420
~GS	0.436	0.408	0.733	0.714

4.2. Construction of Truth Table

The truth table is built in fsQCA3.0 software. First, the fuzzy set data is directly imported into fsQCA software, the result variable is set as PHC, and the condition combination without cases is deleted. The original consistency threshold is set as 0.8, the case frequency threshold is set as 1, and the condition combination with the result variable as PHC is retained to 100%. The truth table of the result variable as PHC is obtained. After that, we set the outcome as the reverse variable Not High PHC, and the truth table of the result variable as Not High PHC can be obtained.

As shown in Table 3, this paper summarizes the following two configurations that affect the rapid development of port logistics and summarizes three configurations that do not. The notation in Table 3 is as follows: ● to indicate that a condition variable appears, and ⊗ to

indicate that a condition variable does not. The large circle represents the core condition and the small circle represents the edge condition. A space indicates that a condition variable is not important and can be present or not. The core condition refers to the condition variables that appear in both intermediate and edge solutions and are of great importance to the result variables. Edge conditions refer to the condition variables that only appear in the intermediate solution. Compared with the core variables, edge conditions are less important.

In Table 3, each column represents a possible conditional configuration. It is preliminarily found that the consistency of all conditional configurations is greater than 0.8, indicating that all cases meet the consistency condition, that is, the 2 types of conditional configuration are sufficient conditions leading to the rapid development of port logistics. In addition, the overall consistency is 0.996 and the overall coverage is 0.913, both of which were higher than the critical value, indicating that the empirical analysis is effective and had higher explanatory power for necessity.

Table 3. Configuration Analysis of Port Logistics Development

Conditional variable	High PHC		Not High PHC		
	H1	H2	NH1	NH2	NH3
PI	●	●	⊗	⊗	⊗
PS	●	●	⊗	⊗	⊗
CCI	●	●			⊗
PE	●	●	⊗		
GS	⊗	●		⊗	
Consistency	0.992	0.996	0.972	0.972	0.998
Coverage	0.434	0.844	0.872	0.863	0.859
Unique Coverage	0.069	0.479	0.040	0.005	0.210
Solution Coverage	0.913			0.879	
Solution Consistency	0.996			0.969	

4.2.1. Configuration Analysis of Port High Throughput Capacity

Port - enterprise - oriented. Configuration H1 points out that port infrastructure and scale, port-adjacent enterprises, and non-strong government support are the core conditions, and hinterland economic development is the marginal conditions. H1 shows that in the case of limited government budget and limited urban economic development, the port mainly relies on its natural geographical advantages to attract enterprises for investment. Through round after round of investment attraction, the amount of investment can be used to improve infrastructure and continue to attract larger-scale investment for the development of the port itself and enterprises. Typical ports in this configuration include Incheon Port. According to related statistics, the throughput of the top three of the nation's economic benefits of Incheon port operations, accounting for 33.8% of the entire city of Incheon, second only to the number of companies and Incheon and related practitioners Pusan port, infrastructure comprehensive ranking in the national front, also conforms to this port - enterprise domination of typical characteristics of configuration solution, but also to verify the port infrastructure, and scale, the development of the enterprise positive role to the development of port logistics.

All-round development. Configuration H2 indicates that port throughput can be effec-

tively improved when port infrastructure and scale, port-neighboring enterprises, and the hinterland economy make positive efforts. Perfect port functions can not only improve the added value of port services, provide good logistics conditions for industrial innovation, but also meet the development needs of high-end service industries, promote the development of port-related industries towards high added value and information, and realize the diversified cross-border operation of port-related industries. To further improve the land transportation system between ports, break through the bottleneck of land transportation channels between ports and form a comprehensive collection and distribution transportation system integrating multiple transportation modes is conducive to expanding the trade transportation between domestic and ports. While strengthening the construction of port hardware infrastructure and landward channel, we should pay special attention to improving the soft power of the port economy, trade, and service. With the help of an excellent trade development environment and service trade advantages, the port should give full play to its advantages in service trade and opening to the outside world and rely on the policy support of the government and the development of port-neighboring enterprises, carry out diversified business operations, and create a trade development environment and policy environment in line with international conventions and rules. The development of port cities plays a positive role in promoting the development of ports. Will promote abundant material resources, human resources, and organizational resources in the form of international trade exchanges to each big port city gathering, these resources will be through the absorption, transfer, transaction, and in situ transformation method is used by the port city, at the same time, foreign companies will also have to follow, many foreign capital and industries excellent talents will be delivery to the port city. At the same time accelerating the rapid development of the port city economy, it also provides a sufficient supply of goods for the development of port logistics, thus promoting the development of port logistics. Most of the port logistics development conforms to this configuration, and the most typical one is Busan Port. As the largest port in the country and the sixth-largest port in the world, Busan port also has a relatively perfect infrastructure. The city where it is located, Busan is the second-largest city in South Korea, and its economic development is also at the forefront of the country. This paper verified the positive effects of port infrastructure and scale, hinterland economy, and port-neighboring enterprises on port development, and showed that the synergistic linkage of the four factors could promote the growth of port throughput, to promote the development of port logistics.

By comparing the two configurations, it is found that from the aspect of coverage, H2's coverage is higher than H1, so H2's explanatory power is higher than H1. H2 to explain the results of the variable is as high as 84%, H1 explanation variable was 43%, the results of two kinds of configuration is the most different is increased the hinterland economy the core conditions and government support the edge conditions, it shows that in developing port infrastructure, and scale, the enterprise, based on if more attention is paid to the hinterland economy, supplemented by the government's support, can improve the port logistics development to a deeper level and effectively.

4.2.2. Configuration Analysis of Nonhigh Throughput Capacity of Ports

Compared with the mainstream statistical methods, the QCA method no longer assumes the symmetry of causal relationship but assumes the asymmetry of a causal relationship, that is, the occurrence of a certain result may require a different "combination of causes" to explain. This paper further analyzes the configuration that affects the non-high throughput capacity of ports, and the analysis results are shown in Table 3.

Configuration NH1: ~ PI * ~ PS * ~ PE, indicating that whether the hinterland economy and government support are superior or not, as long as the infrastructure is not perfect, the

port scale is insufficient, the port-centered enterprises are few and the benefits are general, the port handling capacity will be restricted. Configuration NH2: ~ PI * ~ PS * ~ GS, indicating that whether the hinterland economy and port-neighboring enterprises are superior or not, as long as the infrastructure is not perfect, the port scale is insufficient, and the government support is not good, the port handling capacity will be restricted. Configuration NH3: ~ PI * ~ PS * ~ CCI, indicating that port handling capacity will be restricted no matter whether the port-neighboring enterprises and government support are superior or not, if the infrastructure is not perfect, the port scale is insufficient, and the hinterland economy is poor.

By comparing the above three configurations, it is also found that when the port infrastructure is not perfect and the scale is low, the growth of port throughput will be restrained and the development of port logistics will be affected, whether the hinterland economic benefits are general, the development of port-adjacent enterprises is insufficient, or the government supports are limited.

5. Conclusion and Prospect

5.1. Conclusion

How to promote the development of port logistics is the focus of port research. In ports, multiple environments coexist, the port itself and the location of the port all play an important role in the development of port logistics. Based on the framework of institutional configuration, this paper adopts the fsQCA method to analyze the relationship between port logistics development and the soft and hard environment from the perspective of configuration.

The findings are as follows: First, in the hard environment, port infrastructure, and its scale, as well as in the soft environment, port-neighboring enterprises, the hinterland economy and government support cannot constitute the necessary and sufficient conditions for the development of port logistics. Only combination mode can affect the development of port logistics. Second, the port infrastructure, its scale and the development of port-neighboring enterprises are the core precondition for the development of port logistics but meeting these three conditions does not lead to higher port handling capacity, because it will also be affected by other factors. Thirdly, in the combined model, the hinterland economy and government support have little influence on the development of port logistics. Fourth, whether the port throughput is high or low, it is often affected by the hard environment and soft environment. Fifthly, there is no causal symmetry between influencing port logistics development and inhibiting port logistics development.

5.2. Theoretical Contribution

It is found that the interaction among port infrastructure, its scale, and port-neighboring enterprises can enhance the capacity of port handling and thus promote the development of port logistics. Most of the existing literature studies examine the impact of a single institutional environment separately, ignoring the importance of the coupling relationship between institutional environmental elements. Specifically, based on the overall perspective, this study found the collaborative interaction among port infrastructure, its scale, and port-neighboring enterprises through the research method of QCA, which made up for the lack of existing literature and enriched the relevant research on port logistics.

In terms of research methods, different from traditional regression analysis methods, this study adopts a new method, namely the configuration analysis method (QCA). Port development is usually affected by many factors, but the existing studies focus more on the net effect

of a single factor on port logistics and ignore the interaction among factors. In this study, the QCA method is selected to explore the influence mechanism of port infrastructure, its scale, the hinterland economy, port-surrounding enterprises, and government support on the development of port logistics from the perspective of configuration, which makes up for the deficiency of traditional empirical research methods.

5.3. Revelations and Suggestions

Based on the above research results, the following suggestions are proposed:

The port park should be properly planned and the port infrastructure should be completed. Formulate the development plan of the port logistics industry, improve the layout of the logistics park, realize the dislocation development of functions, promote the integration of regional logistics resources with the construction of the park, and enhance the level of regional logistics intensification. Guide logistics enterprises in warehousing, transportation, bonded, international procurement, regional distribution, and other businesses to gather in port industrial areas. Strengthen the clustering of international logistics enterprises with main freight forwarding, shipping agency, logistics finance, and other businesses in urban central business districts, to optimize the functional layout of the port logistics industry and improve its clustering functions. Advantage of port shipping port-vicinity industry cluster advantages, deepen the port area of logistics operation advantage, form the port logistics and Lingang industrial advantage integration comprehensive logistics park, the land price, investment policy, tax breaks and other aspects to the port logistics enterprises in the park, concentrating on port logistics leading enterprises, establish a frontier, headquarters agglomeration function, joint logistics trade integration operation platform. At the same time, we should continue to optimize the transportation network and other infrastructure and improve functional supporting services, especially the application of information technology and artificial intelligence in infrastructure construction. Improve the industry's application of smart logistics networks and the integration of the Internet of things with the Internet, introduce high-end port logistics talents, and build an online and offline combination of the port hinterland and transit logistics demand channel network.

Supporting high-end port service construction. Based on steadily advancing port infrastructure construction, we will expand port processing, distribution, bonded and trade functions with high added value, develop high-end service industries, enhance soft environment strength, and speed up the construction of port functional facilities, warehousing logistics, and exhibition and trading projects. Integrate the existing resources of the port, shorten the stay time of ships and goods in the port, provide large modern warehouses for logistics service providers, create “zero storage” for customers, and make the existing collection and distribution facilities of the port complete the function of goods distribution. To promote the development of the port, the port can also carry out cross-industry cooperation with large enterprises to transform the port into a distribution center of import and export products. Ports in different regions can establish container terminal companies together to carry out cross-regional cooperation in the form of capital cooperation. While realizing their development strategies, they also accelerate the development of the logistics industry of the invested ports, forming a new pattern of port resource integration and port logistics development.

Formulate plans for the development of the port-neighboring industry, promote industrial structure optimization. For the non-comprehensive port, it is more important to make the port development plan correctly. With the development of port logistics as the center, it will promote the industry through a series of preferential policies and measures to gather in the adjacent port industrial park. We should focus on the introduction of industries supporting

products to extend the industrial chain. At the same time, we should speed up the introduction of related projects downstream of the industry and the integration of the original industries, to further extend the industrial chain and make the industry bigger and stronger. With the continuous concentration of the same industry in the port area, it will produce a huge agglomeration and diffusion effect, promote the leapfrog development of the port city economy, and promote the adjustment and optimization of industrial structure. For comprehensive ports, it is more important to establish strategic cooperative relations with other ports. A special port marketing association can be established to publicize and promote port international container logistics services to ports in neighboring countries, to establish long-term strategic cooperative relations with neighboring ports. Carry out market research and visit according to customer demand, adopt different customer strategies, make different port rates. At the same time to strengthen the port marketing function, the port logistics service marketing information system can also be built, and information sharing can be carried out for production enterprises, surrounding customers' ports, shipping enterprises, and management institutions, and a one-stop composite port logistics information system can be established.

5.4. Lack of Research and Prospect

This paper also has the following deficiencies, worthy of further study in the future.

First, this study is limited by the availability of port data. Due to the Gyeonggi province government measure, the hinterland economy has not announced the same period of comprehensive climate index, so this research only eliminates the Gunsan Port outside the South Korean port throughput. 11 more ports are studied, and the results to a certain extent, affect the potential replication of collecting more data from ports in the future in producing high throughput of port logistics development in further analysis. Second, as part of the port and the city's statistics and research, this study only looks at the static data, and given the QCA method for a dynamic time change the application to be perfect, we collected data across time and the rational development of sequential QCA method. We studied how changes in the port environment "track" affect the change of the port throughput "track." Finally, as we only have 11 samples, the corresponding precondition can only be 4-7. However, the actual factors affecting the development of port logistics are more diversified, so the development of port logistics can be further analyzed from other different perspectives in the future.

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