# How to Measure the Level of Trade Facilitation in a Small Area: Evidence from China

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***Abstract*—This paper aims to measure the level of trade facilitation in a smaller region, and takes Zhejiang Province as an example to illustrate the practicability of the index system. Our index system includes five primary indicators which are transportation, customs, regulation, finance as well as information and technology, respectively. Through the analytic hierarchy process, transportation conditions and customs environment are the top two factors which have a profound and lasting influence on the international trade. In the example analysis, I observed that the level of trade facilitation in Zhejiang is higher than that of the national average, which is largely because the improvement of transportation and IT. In the post-pandemic era, to improve the level of trade facilitation, those five dimensions should be attached great importance to. So, this paper has not only designed a framework to assess the trade facilitation level, but also provided a theoretical reference for government to promote trade and coordinate regional development.**

***Index Terms*—Analytic hierarchy process, China, evaluation system, trade facilitation.**

## I. Introduction

The level of trade facilitation is directly related to a country's openness and international trade competitiveness. Some scholars have shown that the improvement of trade facilitation level is conducive to developing export markets, maintaining the stability of trade relations and promoting foreign trade enterprises to become bigger and stronger. With the increase of trade flow, the improvement of trade structure and the enhancement of inter-regional trade links, reducing transaction costs and establishing an efficient trade facilitation system have become important demands for regional economic and trade cooperation. However, the rise of world trade protectionism and the worldwide spread of COVID-19 have a negative influence on the stability of the global supply chain as well as the industry chain. According to the report of the global economic and trade friction index, the global economic and trade friction index was at a high level for nine months in 2020, and showed a fluctuating upward trend as a whole. In November 2021, the 15$^{th}$ G20 leaders' summit reached positive consensus on major issues such as developing the digital economy, maintaining multilateral trade and achieving global economic and financial stability, showing the determination of the world's major economies to jointly meet challenges. Therefore, it is of great practical significance to explore the problem of trade facilitation in the post-pandemic era.

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As the world's second largest economy, China's trade facilitation process has been accelerating. In 2015, China accepted the protocol to the agreement on trade facilitation, making further progress in creating a convenient customs clearance environment. According to the trade promotion index which was formally released by the world economic forum in 2016, China ranks 61 out of 136 economies, leading other developing countries. According to China's annual report on trade facilitation 2021, China's trade facilitation index increased from 73.05 in 2017 to 77.92 in 2021. Although China has made great achievements in improving the level of trade facilitation in recent years, the current situation of trade facilitation cannot keep up with the development pace from a large trading country to a powerful trading country, and there is a certain distance from the international benchmark. Compared with Singapore which has a high level of trade facilitation, China's transport environment especially port infrastructure and information and communication technology, need to be improved. In addition, how to improve the efficiency of border management needs to be considered. The gap in domestic market access is mainly reflected in the low share of duty-free imports and high import tariffs. So, it is necessary to evaluate the trade facilitation objectively and to advance the development of trade. An important fact of China's economic development is that there are regional differences and imbalances. The country-oriented trade facilitation system cannot be fully applicable to different domestic regions. Therefore, this paper aims to explore the construction of regional trade facilitation level system and the measurement of trade facilitation level.

Firstly, this paper reviews the relevant literature on trade facilitation at home and abroad. Secondly, through the analytic hierarchy process software, this paper constructs the provincial trade facilitation index system, then takes the eastern coastal city- Zhejiang Province as an example to illustrate the applicability and practicability of the system. Finally, this paper makes a conclusion.

## II. Related Literature

### A. Concept of Trade Facilitation

So far, there is still no clear and unified standard definition of trade facilitation. The concept of trade facilitation defined as the simplification, modernization and coordination of import and export procedures, was first put forward by WTO at the 9$^{th}$ Ministerial Conference in Singapore in 1996. Later, OECD extended the connotation of trade facilitation to service trade, labor mobility and other fields. In 2002, UNCTAD mentioned that trade facilitation is the

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simplification of recognized customs, practices and procedures and the coordination of laws and regulations related to transport and trade. APEC defined trade facilitation as a border measure to reduce the trade of import and export goods and accelerate the flow of goods in Trade Facilitation Action Plan. WCO pointed out that simplifying and coordinating customs procedures and applying information technology can effectively speed up the customs clearance of goods and ensure the security of trade. On this basis, Hu [1] believed that trade facilitation is transitioning from simplifying border measures to improving a country's business environment.

To sum up, the trade facilitation is the mainstream trend. And the topic of trade facilitation has been especially concerned by academia for years. Although the definition of trade facilitation varies, the core of trade facilitation is basically the same.

### *B. Assessment of Trade Facilitation*

The evaluation criteria for trade facilitation were studied earlier abroad. The evaluation criteria for trade facilitation by major international organizations are shown in Table I, of which the ETI index constructed by WEF is the most representative.

TABLE I: EVALUATION CRITERIA BY MAJOR INTERNATIONAL ORGANIZATIONS

| Organizations | Evaluation criteria |
|---|---|
| WTO | Information, transparency, prior ruling power, document simplification and other 14 aspects |
| WEF | Transport and infrastructure, border, business environment and market access |
| APEC | Customs procedures, standardization, e-commerce and business mobility |
| OECD | 16 trade facilitation indicators including all border procedures |

In addition, scholars also attempt to build the evaluation standard. Wilson, Mann *et al*. (2005) [2] evaluated trade facilitation from four aspects: customs, port, regulation and service sector infrastructure. Shepherd and Wilson (2009) [3] included the number of documents, time and cost required for import and export into the trade facilitation index system, and found trade flows in southeast Asian countries are more vulnerable to transport infrastructure and information and communication technologies. Shepherd and Dennis (2011) [4] adopted the cross-border trade index of the world bank business environment index as the proxy variable of trade cost to test the impact of trade facilitation on export diversity. Felipe and Kumar (2012) [5] used the logistics performance index to measure the impact of the trade facilitation level of Central Asian countries on bilateral trade from three aspects: customs, infrastructure and logistics. Sakyi, Villaverde, and Maza (2017) [6] constructed the evaluation indicators of trade cost, export cost and import cost to calculate the trade facilitation level among 35 African countries.

Subsequently, Chinese scholars also studied how to evaluate the level of trade facilitation. Duan and Huang (2011) [7] constructed a trade facilitation evaluation system with four primary indicators including logistics and infrastructure, customs and border, government and finance, and policy and nine secondary indicators. They concluded that China's trade facilitation level is lower than that of developed countries and higher than that of most developing countries. Kong and Dong (2015) [8] constructed an evaluation system based on four primary indicators of border and customs, ports and logistics, finance and e-commerce, government and law and 22 secondary indicators. They concluded that the level of trade facilitation in northern Europe is the highest, followed by Western and central Europe, and there is much room for improvement in the level of trade facilitation for Asian and European countries, especially Central Asia and East Asia. Zhu (2019) [9] selected five first-class indicators: port efficiency, e-commerce, customs, regulation and operating environment to calculate the level of trade facilitation in South Asia. Zhang (2019) [10] constructed a system including five primary indicators such as cultural environment and 20 secondary indicators to evaluate the trade facilitation level of 22 countries such as China, Singapore and the United Arab Emirates.

Then, scholars analyze the trade facilitation level of provinces and cities, expanding the applicability and practicability of trade facilitation evaluation system. Zhao (2018) [11] constructed an evaluation system with 4 primary indicators and 21 secondary indicators to measure the level of trade facilitation in Guizhou Province. Li (2019) [12] constructed a system with 4 primary indicators and 16 secondary indicators to evaluate and compare the trade facilitation level of three Pilot Free Trade Zones (Shanghai, Zhejiang and Guangdong).

In conclusion, questionnaire, statistical analysis and index system are the main methods to evaluate the level of trade facilitation. Most international organizations build an index system on the basis of questionnaire survey to study the level of trade facilitation of various countries. Although the indicators of trade facilitation evaluation system at home and abroad are different, the basic direction is similar, and the measurability of trade facilitation is recognized all over the world. However, the research on trade facilitation is mostly based on the national perspective. So, I attempt to study trade facilitation from provincial perspective.

### *C. Economic Consequences of Trade Facilitation*

Based on the computable general equilibrium model and the probit model, Hummels *et al*. (2001) [13] found that the reduced cost per day of customs clearance time is equal to the ad valorem tariff cost of 0.5%. Wilson *et al*. (2005) [2] used gravity model and found that the benefits of unilateral trade facilitation reform are great, mainly through the expansion of exports. Felipe and Kumar (2012) [5] found that the improvement of trade facilitation in Central Asian countries significantly increases the trade volume, among which the improvement of infrastructure plays the largest role. Later, Kong and Dong (2015) [8] found that trade facilitation plays a greater role in promoting international trade than GDP and regional economic integration organizations. Zhan *et al*. (2017) [14] found improving the level of trade facilitation will significantly promote the growth of bilateral fruit trade between China and ASEAN, and transportation and e-commerce play the most significant role in promoting fruit trade. Gan (2017) [15] used the gravity model to study the impact of the level of trade facilitation of China, Japan, South

Korea and the United States on bilateral trade, and found the improvement of the level of trade facilitation of a country is not only conducive to its own exports, but also significantly promote the exports of its partner countries. Cheng and Wang (2020) [16] used grey relational grade analysis to study the influencing factors of China's cross-border e-commerce export trade facilitation.

In conclusion, gravity model is often used in the empirical analysis of trade facilitation. The impact of trade facilitation on exports has attracted the attention of many scholars.

## III. Construction and Application of Trade Facilitation Evaluation System

### A. Construction of Trade Facilitation Evaluation System

1) Indicator description: Based on the research of Duan and Huang (2011) [7], and combined with the current situation of trade facilitation in China, we finally constructed a trade facilitation evaluation system which includes 5 primary indicators and 17 secondary indicators. Primary indicators contain transportation environment, customs environment, regulatory environment, financial environment as well as information and technology.

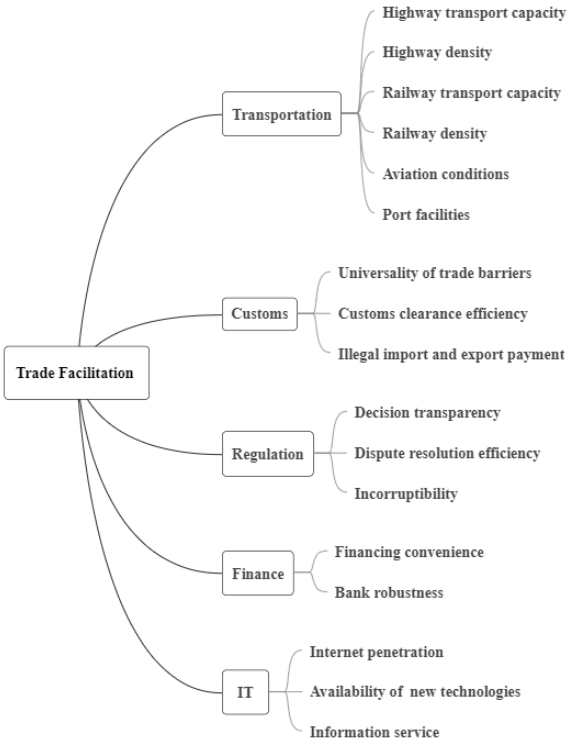


Fig. 1. Evaluation index of trade facilitation level.

Fig. 1 shows the detail. Transportation index includes highway transport capacity, highway density, railway transport capacity, railway density, aviation condition and port facilities. Customs index covers university of trade barriers, customs clearance efficiency and illegal payment. Regulation index covers decision transparency, dispute resolution efficiency and incorruptibility. Finance index includes financing convenience and bank robustness. IT index covers Internet penetration, availability of new technologies and information service.

2) Indicator weighting: I gave weight to each index according to the following four steps by using the analytic hierarchy process software. Firstly, a hierarchical structure model is established, with the level of trade facilitation as the target layer, the primary index as the criterion layer and the secondary index as the scheme layer. Secondly, I built a matrix to judge the relative importance of each element at the same level, and observed whether the consistency ratio is less than 0.1. Finally, the weight of secondary indicators to each primary indicator and the weight of primary indicators to the target layer were determined respectively. The final results are shown in Table II. The weight of transportation environment is 0.3618. The weight of customs environment is 0.3137. The weight of regulatory environment is 0.1536. The weight of financial environment is 0.0880 and the weight of information technology is 0.0828.

TABLE II: Index Weight of Trade Facilitation Evaluation System

| Primary index | Weight | Secondary index | Weight |
|---|---|---|---|
| Transportation | 0.3618 | Highway transport capacity | 0.1126 |
| | | Highway density | 0.1126 |
| | | Railway transport capacity | 0.1377 |
| | | Railway density | 0.1934 |
| | | Aviation conditions | 0.1126 |
| | | Port facilities | 0.3311 |
| Customs | 0.3137 | Universality of trade barriers | 0.4000 |
| | | Customs clearance efficiency | 0.4000 |
| | | Illegal import and export payment | 0.2000 |
| Regulation | 0.1536 | Decision transparency | 0.5000 |
| | | Dispute resolution efficiency | 0.2500 |
| | | Incorruptibility | 0.2500 |
| Finance | 0.0880 | Financing convenience | 0.5000 |
| | | Bank robustness | 0.5000 |
| IT | 0.0828 | Internet penetration | 0.3333 |
| | | Availability of technologies | 0.3333 |
| | | Information service | 0.3333 |

In the whole system, the transportation condition accounts for the largest proportion, followed by the customs environment. Among transport indicators, port facilities are the largest part because shipping is the major way of the international trade. Among customs indicators, trade barriers and clearance efficiency appear more important. Regulation and finance are also essential to international trade. Besides, nowadays, the role of information and technology becomes increasingly crucial to trade facilitation.

### B. Calculation of Trade Facilitation Level

Due to the differences in data units and value ranges, I carried out the following standardized processing, as shown in (1) and (2).

$$S_{ij} = C_{ij} / (C_{ij})_{\max} \tag{1}$$

$$Z_i = \sum S_{ij} W_{ij} \tag{2}$$

$C_{ij}$ is the initial data of the $j^{th}$ secondary index under the $i^{th}$ primary index. $(C_{ij})_{max}$ is the maximum value among $C_{ij}$. $S_{ij}$ means the standardized value of each secondary index. $W_{ij}$ is

the weight of the secondary index relative to its primary index, and $Z_i$ is the standardized value of each primary index.

In this way, the range of all data is from 0 to 1. The higher the value, the higher the level of trade facilitation. Finally, the calculation process of trade facilitation level is shown as (3).

$$TFI = (\sum_{i=1}^{5} W_i Z_i) \times 100 \quad (3)$$

The standardized value of each level index is multiplied by the corresponding weight of the index, and then added. On this basis, it is multiplied by 100 to form the final index. $Z_i$ is the standardized value of each primary indicator. $W_i$ is the weight of each primary indicator relative to the target layer. TFI represents the trade facilitation level of each region, and ranges from 1 to 5.

### C. Application of Trade Facilitation Evaluation System

I took Zhejiang Province, one of China's southeastern coastal cities, as an example to illustrate the specific application of the index system constructed above. To this end, I first collected data from Global Competitiveness Report, Global Enabling Trade Report, Zhejiang Provincial Bureau of statistics and the National Bureau of statistics. Data of eight secondary indicators which are the universality of trade barriers, the efficiency of customs clearance, illegal import and export payment, the transparency of government decision-making, incorruptibility of the government, dispute resolution efficiency, financing convenience and the bank robustness are adopted from national level, because there are no significant differences between the national and regional level.

Then, I dealt with the problem of incomplete data. As for the transparency of government decision-making and illegal import and export payment, referring to the data processing method in Global Competitiveness Report, I replaced the missing data by the same index data of the previous year. As for the customs clearance efficiency, given that the data of each year are similar and stable, I filled in blanks with the arithmetic average of adjacent data. Following Eq. (1-3), I calculated the trade facilitation index (TFI) for the calendar years from 2004 to 2020, as Table III shows.

TABLE III: TRADE FACILITATION LEVEL OF ZHEJIANG

| Year | TFI | Transport | Customs | Regulation | IT |
|---|---|---|---|---|---|
| 2004 | 62.52 | 12.34 | 28.49 | 12.00 | 6.28 |
| 2005 | 66.01 | 16.99 | 28.01 | 11.63 | 6.48 |
| 2006 | 70.14 | 19.43 | 28.55 | 12.39 | 6.81 |
| 2007 | 80.48 | 26.48 | 29.10 | 13.96 | 7.39 |
| 2008 | 80.36 | 25.14 | 29.03 | 14.71 | 7.54 |
| 2009 | 82.96 | 26.93 | 29.33 | 14.80 | 7.72 |
| 2010 | 84.40 | 28.43 | 29.36 | 14.64 | 7.87 |
| 2011 | 82.97 | 28.73 | 28.59 | 14.32 | 7.66 |
| 2012 | 82.93 | 28.34 | 29.03 | 14.44 | 7.77 |
| 2013 | 85.39 | 29.93 | 29.39 | 14.61 | 8.01 |
| 2014 | 85.04 | 30.77 | 28.61 | 14.14 | 7.67 |
| 2015 | 87.87 | 31.53 | 29.60 | 14.49 | 8.07 |
| 2016 | 90.34 | 32.40 | 30.47 | 14.61 | 8.14 |
| 2017 | 93.77 | 35.12 | 29.77 | 13.87 | 8.04 |
| 2018 | 91.37 | 34.01 | 29.77 | 14.06 | 8.04 |
| 2019 | 92.17 | 34.33 | 29.45 | 14.12 | 8.05 |
| 2020 | 91.33 | 35.06 | 28.01 | 13.92 | 8.05 |

TFI also reflects changes in the domestic and international economic environment. The decline of TFI in 2008 may be affected by the global economic crisis. Since 2016, the completion of port integration, the promotion of Yangtze River Delta integration strategy, the construction of Free Trade Pilot Zone and the cross-border e-commerce comprehensive pilot zone have facilitated the trade, so, to some extent, TFI has exceeded 90. And the decline of TFI in 2020 may be affected by COVID-19.

The index I obtained exceeds the national average, which can be explained from the following perspectives:

1) There are some differences between the specific indicators. That is to say, indicators at the national level represent the balanced development of all regions. Indicators at the provincial level are relatively closer to the development of a small area.
2) Zhejiang Province which is located in the Yangtze River port, is a strong economical province in China in addition to the special economic zones outside, and enjoys many preferential policies. It is no wonder that the growth rate of a number of economic indicators in Zhejiang has exceeded the national average, with obvious advantages of open economy.
3) The great improvement in transportation and IT leads to the improvement in Zhejiang's trade facilitation. Because transportation conditions' share is the largest in our index system, the level of trade facilitation has increased a lot.

## IV. CONCLUSION

First, different from the previous research on the construction of trade facilitation index system from the national level, this paper constructs an index system suitable for smaller regions, whose primary indicators contain transportation, customs, regulation, finance as well as information and technology.

Second, through the analytic hierarchy process, I found that transportation environment is the most important factor affecting regional trade facilitation, followed by the customs environment. Given that maritime transport is the main mode of trade between countries, port facilities are vital to promote trade facilitation.

Third, I used data of Zhejiang to show the application of the index system. Generally speaking, Zhejiang has a high level of trade facilitation. The improvement of Zhejiang's trade facilitation level largely benefits from the improvement of transportation conditions and technology. Meanwhile, I also found that TFI can reflect certain international economic situations.

In general, this paper attempts to measure the level of trade facilitation in a smaller region with more comprehensive dimensions, thus providing a theoretical reference for the region to improve the level of trade facilitation and for regional coordinated development.

Due to the limited time, information collection, literature induction and data processing capacity, this paper has some shortcomings. On the one hand, the trade facilitation system does not include some indicators that are not easy to quantify. On the other hand, when it comes to determining weights of

indicators, the relative importance of each index is judged subjectively.

In the future, how to build an index system to evaluate the level of regional trade facilitation is still of great significance. In addition, the impact of information technology and financial environment on trade facilitation is worth being analyzed separately. Besides, it is necessary to combine the changing circumstances to make the countermeasures and suggestions more comprehensive and targeted.

## Conflict of Interest

The author declares no conflict of interest.

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