

A Study on the Credit Evaluation Indicator System of China's Waterway Transportation Market

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Abstract. This paper systematically analyzes the construction of credit systems both domestically and internationally. Taking into account of the current state of credit evaluation management in China's waterway transportation market and the characteristics of market entities, this paper proposes a credit evaluation indicator system for practitioners in waterway transportation market. The indicator system has the advantages of easy data acquisition and strong operability, and has achieved good application in practice.

Keywords: credit; waterway transportation; market; evaluation indicator

1. Introduction

In recent years, the CPC Central Committee and The State Council have attached great importance to the construction of the social credit system. In 2014, *the Outline of the Plan for the Construction of the Social Credit System (2014-2020)* was issued, which is China's first special plan for the construction of the national social credit system. The policy document emphasized that assessment indicators shall be formulated for different business categories in highway, railway, waterway, civil aviation, and pipeline, and supervision and management of credit assessment and evaluation shall be strengthened. Waterway transportation plays a crucial role in China's comprehensive transportation system, accounting for over 85% of the total freight volume of China's foreign trade. The transportation sector is a key area for credit system development, and specific evaluation indicators should be formulated for different types of operations within the waterway transportation market. Therefore it is essential to gradually establish a credit system for the waterway transportation market. At present, credit system development in China's waterway transportation market remains in its initial stage, and it is of great significance to make further advances in the development of credit evaluation indicator system for the waterway transportation market.

At present, there are few researches on credit evaluation of transportation in China and foreign countries, especially in waterway transportation. Liu, T. (2017) has constructed the credit evaluation indicator system framework of Yangtze River waterway transport operators and proposed the credit evaluation method of Yangtze River waterway transport operators[1]. Zhu, J. (2018) has constructed the credit evaluation indicator system with basic quality, operation integrity, safety integrity and other integrity as the main contents[2]. Mao, H. et al. have constructed a credit evaluation indicator system for dangerous goods carried in containers[3].

In terms of foreign research, there is no relevant research on credit evaluation in the field of waterway transportation. This paper is committed to building a credit evaluation indicator system for the entire waterway transportation industry. Different from the existing research, this paper's indicator setting is more concise and the data acquisition is more convenient, which greatly improves the work efficiency of credit supervision and is of great significance for the construction of a new transportation supervision mechanism with credit supervision as the core.

1.1 Definition of credit

The national standard "*Basic Terms of Credit*" (GB/T22117-2008) defines credit as the trust-based ability to obtain funds, goods, or services without the immediate need for payment or collateral. This ability is typically conditional upon a commitment to repay within an agreed-upon timeframe.

1.2 Definition of credit evaluation

The national standard "*Basic Terms of Credit*" (GB/T22117-2008) defines credit evaluation as the evaluation (or estimation) of credit risk for various types of organizations or institutions, and the indication of their credit rating using specialized rating symbols.

1.3 Definition of credit evaluation of shipping enterprises

Credit agencies conduct credit risk evaluations for shipping companies, demonstrating the probability of their ability and willingness to repay debts in the future. In these evaluations, credit ratings are typically indicated by specialized rating symbols.

2. Summary of Credit System in China and the World

2.1 Overview of the credit system in major developed countries

Social credit systems in developed market economies have been in three different models, based on their specific national conditions and legislative traditions: the fully market-oriented model represented by the United States, the government and central bank-led model represented by Europe, and the membership-based model represented by Japan.

The U.S. model has gradually evolved and developed through the involvement of third-party credit agencies which are independent from government and financial institutions, while adapting to market demands. In this model, the credit reporting process primarily involves private companies, and adopts a market-driven approach. Market competition plays a significant role in the credit reporting process, encouraging credit reporting agencies to improve their service quality in various ways for the ultimate purpose of maximizing consumer satisfaction. This model benefits from effective corporate governance structures, which help avoid issues of inefficiency and narrow credit scope.

The European model is characterized by a public credit reporting system primarily led by central banks or their subsidiary institutions. This credit reporting model is built on a foundation of public authority, and it mandates that businesses and individuals must provide their credit data to these institutions. Legislation is in place to ensure data accuracy. This approach is efficient and makes it relatively easy to establish a nationwide credit system. The deep involvement of

central banks and government authorities enables effective collaboration with various departments at national level. However, a drawback of this model is that credit reporting agencies often have backgrounds in banking associations, government bodies, or non-profit organizations. This makes them less market-driven and primarily focused on credit within their own industry, which may limit their ability to meet a wide range of market demands for credit.

The Japanese model forms the basic support of the social credit system through combining membership-based credit institutions and commercial credit institutions established by the banking association. This model generally does well in meeting the demand for information collection and provision. However, a major drawback of this model is that only member organizations can access the information provided by credit reporting agencies. This limitation means that the scope of credit information offered is relatively narrow and hence falls short of achieving the goal of comprehensive credit reporting.

In summary, the insights from the development of social credit systems in foreign countries highlight several key points: a robust legal framework is essential as a foundation for credit system development; an effective credit management system should be in place to support the credit system; the application of credit rating results fosters a favorable market environment for the credit service industry; the legal status of information transparency provides valuable government information resources for building the credit system; establishing clear rules for the credit market is crucial[4][5].

2.2 Development of China's credit system

Main work at the national level. a) the issuance of *the Outline of Social Credit System Construction Plan (2014-2020)*; b) the issuance of *the Guiding Opinions of the State Council on Establishing and Improving the Joint Incentive and Penalty System for Trustless and Accelerating the Construction of Social Integrity (No.33)*, initially promoting the establishment of the joint punishment system; c) the establishment of the public credit information sharing mechanism, including the interconnection and sharing among public departments and the development of "Credit China" website.

Main work at the provincial level. Many provinces in China have been actively exploring and making progress in developing social credit systems. Taking Zhejiang and Jiangsu as examples, both provinces have taken significant steps by establishing leadership groups for credit system development, with a vice-governor serving as the group leader. Additionally, they have set up credit system development offices led by officials from the Development and Reform Commission (DRC), and established credit system development centers, often categorized as Class-A public welfare institutions under the provincial DRC. The two provinces have also launched local credit platforms for external services, such as "Credit Zhejiang" and "Credible Jiangsu," which connect to the national "Credit China" system.

Main work at the industry level. In various sectors, such as finance, judiciary, commerce, taxation, customs, logistics, and transportation, there have been ongoing efforts to explore and develop industry-specific credit systems, which have yielded valuable experiences and achievements.

The development of social credit systems in various industries and regions in China offers several valuable practices for consideration: a) laws and regulations are the institutional

guarantee of credit system development; b) promotion and support of the government is an important condition for credit system development; c) credit information system is the core project of credit system development; d) step-by-step implementation is the basic method of credit system development[6].

3. Current Situation of Credit Evaluation and Management in China's Waterway Transportation Market

3.1 Development status and characteristics

China's waterway transportation market includes five parts: domestic waterway transportation market, international waterway transportation market, domestic waterway transportation auxiliary market, international waterway transportation auxiliary market, and port operation market. The five segments differ from each other in terms of market size and management mechanism. The domestic waterway transportation market is fully open to all types of enterprises, so there are a large number of market players, mainly small and medium-sized companies, and this market is faced with challenges of small business size and difficult supervision. The international shipping market is fully open to the world with a high degree of internationalization. International shipping enterprises are generally large and their operation is relatively standardized. The domestic waterway transport auxiliary market has a low entry threshold, hosts a very large number of market players which are generally small in business size and asset value, with high employee turnover, and therefore the market is highly competitive. The international waterway transportation auxiliary market also sees a large number of companies which are mainly small and medium-sized companies, and have small operation scale and high employee turnover, and hence the market is highly competitive as well while non-compliant behavior often occurs, making it challenging for routine supervision. Port businesses vary in size and encompass a wide range of activities, with significant differences among various segments, and therefore it can be difficult to measure the credit situation of different segments by using a unified credit evaluation standard[7].

3.2 Current situation of credit evaluation and management

While the Ministry of Transport of China has not issued management measures governing credit evaluation of the waterway transportation market, some provincial and regional waterway transportation regulatory agencies have made active explorations in the field of credit evaluation based on the local reality. For example, Since 2002, according to the *Qualification and Reputation Evaluation Indicator System of Shipping and Its Auxiliary Industries* and the *Credit Rating Evaluation Standard*, Shanghai has carried out credit evaluation of shipping and its auxiliary enterprises, evaluating international shipping and its auxiliary enterprises and domestic waterway transport enterprises from the aspects of qualification maintenance, enterprise quality, enterprise credit and reputation. In 2013, Yangtze River Navigation Administration Bureau issued the *Implementation Plan for The Evaluation of Yangtze River Honest Shipping Enterprises (Trial)*, which evaluated the credit of Yangtze River shipping enterprises from five aspects: basic qualification, business behavior, transportation safety, service quality and social responsibility. In 2016, Jiangsu Provincial Department of Transport issued the *Credit Management Measures of Jiangsu Provincial Road and Waterway Transport*

Operators, which evaluated the credit of Jiangsu provincial waterway cargo transport operators mainly from four aspects: production safety, business behavior, service quality and information submission. Xiamen Port Administration authorized Xiamen Shipowners' Association to carry out credit evaluation of port and shipping enterprises annually. However, research shows that most credit evaluation is not very much operable, and hence is not widely applied. According to the survey feedback, most credit evaluation adopts the bonus point mode, and the indicator data is difficult to collect, the operability is not strong, there are many subjective factors, and the evaluation results have not been well applied[8][9].

4. Construction on the Credit Evaluation Indicators of Water Transportation Market Operators

4.1 Principles of indicator design

The design of the credit evaluation indicator system of the waterway transportation operators shall follow the following principles: a) Scientific. Indicators should be representative and align with the characteristics of the entities involved. Indicators should be as quantifiable as possible, minimizing the subjective element; b) Independent. Indicators should be as mutually independent as possible; c) Tiered. Breaking down the credit evaluation indicator system into multiple sub-levels based on the extent of content coverage and international standards is a useful approach; d) Practical. The design of indicators should be straightforward for understanding, collection, and utilization; e) Targeted. The indicator system should emphasize the characteristics of the industry and be designed with a focus on the concerns of industry regulatory authorities, relevant stakeholders, and the general public[10].

4.2 Reference basis

The reference basis for the selection of credit evaluation indicators of waterway transportation operators includes:

—— *Port Law of the People's Republic of China, Regulations of the People's Republic of China on International Maritime Shipping, Regulations on the Administration of Domestic Waterway Transport* and other laws and regulations;

—— *Notice of The State Council on Printing and Distributing the Outline of the Construction Plan of Social Credit System (2014-2020), Measures for the Management of Credit Information of Waterway Transport Market (Trial) (No.128,2017)* and other national policy documents;

—— The connotation of credit evaluation of waterway transportation market operators;

—— Experiences of transportation regulators to manage credit indicators of market operators;

—— Development trends of the waterway transportation market and the characteristics of operators.

4.3 Selection of indicators

Credit evaluation indicators of waterway transportation operators are selected from the *Management Measures for Credit Information of Waterway Transport Market (Tentative)*

(No.128, 2017). The scoring of indicators is classified based on the severity of administrative penalties for illegal and non-compliant behavior. It is primarily divided into four levels: 2 points per occurrence, 5 points per occurrence, 10 points per occurrence, and directly designated as D-grade.

The credit evaluation indicator code for the waterway transportation market is shown in Figure 1. Credit evaluation indicators are categorized according to business areas, and the classification codes and names for the indicator items are listed in Table 1. Each category of evaluation indicators corresponds to one or more instances of non-compliant behavior.

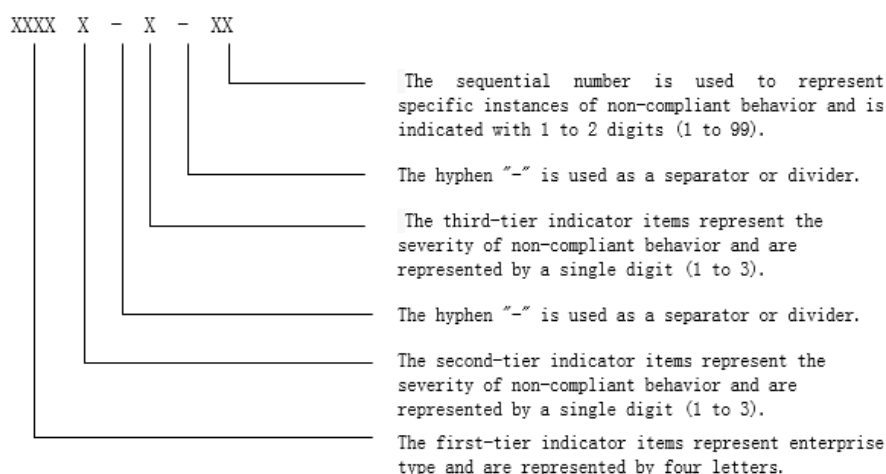


Figure 1. Code structure of credit evaluation indicators

Table 1. Classification codes and names of credit evaluation indicators.

Indicator Item Classification	Name of Indicator	Meaning of Indicator
Tier-1 indicators	SYGK	Port operator
	SYJY	International shipping transportation operator
	SYNY	Domestic waterway transportation operators
	SYND	Domestic waterway transportation agencies
	SYNC	Domestic ship management companies
Tier-2 indicators	1	Business conditions
	2	Business behavior
Tier-3 indicators	1	Serious breach of trust
	2	General breach of trust
	3	Other breaches of trust

Note: Tier-1 indicators represent the category of the evaluation targets, Tier-2 indicators represent the scope of evaluation content, and the Tier-3 indicators represent the severity of non-compliant behavior. The establishment of indicator content takes into account the principle of strong operability. This credit evaluation indicator system is applicable to evaluating authorities at all levels of transportation regulators

and is not applicable to industry third-party credit rating agencies, except those under government commission management.

4.4 Indicator calculation

4.4.1 Calculation formula

The waterway transportation market implements a deduction-based credit evaluation system, with a baseline score of 100 points. Each evaluation item can be deducted repeatedly based on actual occurrences, and deductions cease when all the points are exhausted. If it engages in severe non-compliant behavior, an evaluation target will be directly downgraded to grade “D” according to the evaluation procedure. The credit rating and grading of evaluation targets in the waterway transportation market are conducted on an annual basis. The formula for calculating the comprehensive credit score of waterway transportation enterprises in various provinces of operation is as follows:

$$S = 100 - \sum_{i=1}^n F_i$$

In the formula:

S- -the comprehensive credit score of an enterprise in a certain province;

F_i - -scores are deducted for a breach of trust in a certain province;

n - -the total number of trust-breach behaviors of an enterprise operating in a certain province.

4.4.2 Evaluation results

The credit evaluation results are expressed by the credit rating. The credit rating of the credit evaluation target in the water transportation market is divided into five levels according to the credit degree from high to low, which are expressed by AA, A, B, C and D respectively. The credit rating has the following meanings:

- a) Grade AA: total credit rating score ≥ 95 points, indicating excellent credit;
- b) Grade A: total credit rating score ≥ 85 points, and < 95 points, indicating good credit;
- c) Grade B: total credit rating score ≥ 75 points, and < 85 points, indicating average credit;
- d) Grade C: total credit rating score ≥ 60 points, and < 75 points, indicating relatively poor credit;
- e) Grade D: total credit rating score < 60 , indicating poor credit.

4.4.3 Scoring standard

Taking port operating enterprises as an example, the credit evaluation indicators and penalty deduction standards are shown in Table 2.

Table 2. Classification codes and names of credit evaluation indicators.

Number	Indicator Item Code	Behaviors of Trust Breach	Point Deduction Standard	Remarks
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1	SYGK1-1-1	To engage in port operation without lawfully obtaining the port operation license	/	Downgraded to grade D
2	SYGK1-1-2	To operate the port tallying without legal permission	/	Downgraded to grade D
3	SYGK1-1-3	Port tallying operator also engages in cargo handling and warehousing business	/	Downgraded to grade D
4	SYGK1-1-4	A port operator fails to meet the qualifications for port operation after obtaining the business license	/	Downgraded to grade D
5	SYGK2-1-5	To provide false materials, falsely report and conceal important matters in the process of applying for transportation related administrative license and financial subsidies	/	Downgraded to grade D
6	SYGK2-2-6	A port operator fails to give priority to the operation of emergency rescue materials, disaster relief materials and materials urgently needed for national defense purposes.	5 Points / occurrence	
7	SYGK2-1-7	The port operator fails to give priority to the operation of emergency rescue materials, disaster relief materials or materials urgently needed for national defense purposes, thus causing serious consequences	/	It is directly designated as grade D
8	SYGK2-2-8	The port operator violates relevant laws and administrative regulations by engaging in monopoly or unfair competition during its business activities, discriminates against service recipients with equal conditions, and compels others to accept	10 Points / occurrence	

		the port services it provides.		
9	SYGK2-2-9	The port operator fails to disclose the charging items and charging standards for their operational services or engages in charging practices not publicly disclosed to shippers or passengers.	2 Points / occurrence	
10	SYGK2-2-10	The port operator does not comply with the regulations when the port operator fees are subject to government guidance prices or government-set prices.	2 Points / occurrence	
11	SYGK2-2-11	The port operator fails to truthfully and timely provide relevant statistical data and relevant information in accordance with the requirements of laws and regulations The port operator fails to provide accurate and timely statistical data and relevant information in accordance with legal and regulatory requirements.	5 Points / occurrence	
12	SYGK2-2-12	The port operator makes changes or modifications to its fixed operational facilities without following the required procedures as stipulated by laws, regulations, and rules, or without reporting such changes to the port administrative authority.	2 Points / occurrence	
13	SYGK2-2-13	The port operator fails to promptly and fully pay the port	2 Points / occurrence	

		administrative fees as required.		
14	SYGK2-2-14	The port operator fails to cooperate as required to provide the necessary support for the berthing and departure of ships being guided, and fails to provide the relevant information to the pilotage organization as required.	2 Points / occurrence	
15	SYGK2-2-15	The port operator designates waterway transportation auxiliary service providers for ship owners, operators, cargo consignors, and consignees, offering services such as ship agency and waterborne cargo transportation.	5 Points / occurrence	
16	SYGK2-1-16	Serious trust-breach behavior leading to inclusion in the 'blacklist' for transportation safety	/	Downgraded to grade D
17	SYGK2-1-17	Refusing to comply with or evading the execution of decisions made by transportation regulators.	/	Downgraded to grade D
18	SYGK2-3-X	Other actions deemed as trust-breach behavior (as determined by provincial-level regulators).	2-5 Points /occurrence	

4.5 Case study application

The evaluation indicator system constructed in this paper has been initially applied in the credit evaluation management of waterway transportation market in a province in 2022, and a total of 29 port enterprises have participated in the evaluation. Among them, 18 are rated Grade AA, 6 are rated Grade A, 3 are rated Grade B, and 2 are rated Grade D. According to the practice feedback, the indicator system constructed in this paper is easier to obtain and the operation process is simpler, which has achieved good application effect and solved the problems such as difficult to obtain the indicator data, large subjective interference and difficult to operate by staff.

5. Conclusions

This paper is based on the current state of credit management in the waterway transportation market and conducts preliminary research on credit evaluation standards. It constructs a set of scientific, targeted, simple and easy to operate credit evaluation indicator system, and has achieved good application results, which can be used as a reference for industry regulators. The research outcomes are not yet mature. In the future, there should be further in-depth research to continue the refinement and improvement of the credit rating indicator system. This should ensure that there is research, application, feedback, validation, refinement, standardization, and promotion, forming a closed loop in scientific research management.

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