

# Evaluating the International Competitiveness of China's Railway Enterprises

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**Abstract:** Objective evaluation of the international competitiveness of China's railway enterprises and the effective enhancement of its overall strength are fundamental to the supportive implementation of China's "Go Global" railway strategy. Based on AHP and gray system analysis of internal and external factors influencing the international competitiveness of China's railway enterprises, this paper develops a corresponding evaluation index system of international competitiveness of China's railway enterprises according to its different enterprise types. Furthermore, a comprehensive evaluation on international competitiveness of railway construction enterprises and equipment manufacturing enterprises is conducted. The results show a large growth gap not only in the management capacity and technological innovation of China's railway construction enterprises but also in the asset size, solvency, and creation of equipment manufacturing enterprises.

**Keywords:** China's railway enterprises; international competitiveness; evaluation index system; evaluation results analysis; countermeasures and suggestions

"Go Global" is an important component and basic support of the Belt and Road Initiative in China, and the overall strength and international competitiveness of Chinese railway enterprises is the basic goal of China's "Go Global" railway strategy. Although Chinese railways, especially high-speed railways, have their own unique advantages, there are still some deficiencies and room for improvement in management ability, risk control, adaptability, and innovation ability. Therefore, how to objectively evaluate the international competitiveness of Chinese railway enterprises and effectively improve the enterprises' overall strength and international competitiveness has become key for "Go Global." The construction of Chinese railway enterprises' international competitiveness evaluation index system can help enterprises find their own competitive advantages and disadvantages and thus make improvements in definite objects and effectively improve the international competitiveness of enterprises. This is necessary for "Go Global" and has important theoretical significance and practical value.

## 1 Factors influencing international competitiveness of railway enterprises

Enterprise competitiveness indicates the comprehensive ability of enterprises to obtain and comprehensively use external available resources by cultivating their own resources and abilities under competitive market conditions to achieve their own value on the basis of creating value for customers. Enterprise competitiveness can be considered from business ability, innovation ability, marketing ability, technical ability, asset operation ability, human capital ability, and other specific abilities [1].

### 1.1 External factors

The external factors influencing the international competitiveness of railway enterprises can be defined as the influencing factors of positive interaction between the railway enterprises and all levels of government agencies, group organizations, and

**Received date:** August 23, 2017; **Revised date:** September 11, 2017

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**Funding program:** CAE Advisory Project "Research on China's 'Go Global' Railway Strategy" (2015-ZD-11)

**Chinese version:** Strategic Study of CAE 2017, 19 (5): 068–073

**Cited item:** Li Jingwen et al. Evaluating the International Competitiveness of China's Railway Enterprises. *Strategic Study of CAE*, <https://doi.org/10.15302/J-SSCAE-2017.05.012>

the public. They are also important factors of enterprise competitiveness, including both the ability to obtain policy assistance and the ability to win public recognition.

(1) Degree of conformity with the national development strategy. The core competitiveness of the railway enterprises' "Go Global" strategy comes from conformity and development with national strategic positioning, which integrates the development of a railway enterprise itself into the national development strategy, so as to truly form the vitality and competitiveness of the internationalization of Chinese railway enterprises.

(2) International and domestic economic situation. The recovery process of the global economy faces great uncertainty and extreme imbalance. "Go Global" is both an opportunity and a challenge, and railway enterprises are facing the test of slowing growth and stabilizing exports.

(3) Global trading system and trade patterns. The railway enterprises implement the "Go Global" strategy, and the most serious disputes may come from the fields of intellectual property, labor, and anti-dumping litigation and may interfere with and hinder the "Go Global" process of railway enterprises.

(4) Differences in international geopolitical factors and cultures. The uncertainty and instability of foreign political situations, as well as the differences in regional cultural practices and religious beliefs, will cause significant obstacles to the overseas construction, operation, and management of railway enterprises.

## 1.2 Internal factors

The internal factors influencing the international competitiveness of railway enterprises can be defined as the influencing factors that can actively maintain the competitive advantages of enterprises and are formed and accumulated by the railway enterprises through the value creation process of production operation, organizational management, and technological R&D, and they are also the core elements of the enterprise competitiveness, including both the economic strength of enterprises and the potential development ability of enterprises.

(1) The economic strength of railway enterprises, including economic aggregate, market size, earnings, debt paying ability, and growth space, and playing the roles of both the core factor influencing the comprehensive competitiveness of enterprises and the most important index measuring the enterprise competitiveness level.

(2) The resource endowment of railway enterprises, focused on overseas land resources, overseas environmental resources, overseas raw materials supply channels, overseas transportation resources, information resources, and the most important international professional resources.

(3) The modernization management ability of Chinese railway enterprises. The degree of integrating the potential element characteristics of enterprises into the modernization management philosophy is thoroughly investigated from the following

aspects: strategic deployment, organizational management, enterprise execution, enterprise culture, and risk management.

(4) The technical level of railway enterprises. The Chinese railway enterprises still lack comprehensive system integration ability in the international market competition environment.

(5) The international influence of railway enterprises. The Chinese railway enterprises involved in international competition should seriously examine their own international popularity, product brand image, enterprise social responsibility, and other influencing factors [2].

## 2 Construction of railway enterprise international competitiveness evaluation index system

This study adopts the AHP of combining subjective judgment with objective evaluation to decompose the complex competitiveness evaluation problem into different dimensions of the constituent elements, further decompose these elements according to the dominant relationship, and establish a multi-level progressive analysis structure from overall goal to basic elements and specific indicators [3].

By using the gray system analysis method, the comprehensive gray discriminant matrix is transformed into a whitening matrix, which is used as the weight discriminant matrix in the AHP.

We designed an expert evaluation form in the study (the experts include government officials, enterprise managers, and railway experts from universities and scientific research institutions who have been engaged in railway operation and management for many years) to analyze the data in effectively scoring questionnaires of 30 experts and form 29 matrices for scoring each expert's results. According to the above calculation method, we can provide the weight values of indexes at all levels of the international competitiveness evaluation system of Chinese railway enterprises (Fig. 1).

In the figure, the weights of five indexes of the level 2 index (criterion layer) are: A1, 0.33; A2, 0.23; A3, 0.14; A4, 0.11; and A5, 0.19. The names and weights of 24 indexes of the level 3 index (element layer) are: asset size index (A11), 0.30; efficiency index (A12), 0.27; market size index (A13), 0.16; growth index (A14), 0.17; debt paying ability index (A15), 0.10; talent resources (A21), 0.22; market resources (A22), 0.21; material resources (A23), 0.18; information resources (A24), 0.11; environmental resources (A25), 0.08; resource efficiency (A26), 0.14; comprehensive utilization (A27), 0.06; strategic management (A31), 0.21; organizational management (A32), 0.19; enterprise execution (A33), 0.20; enterprise cultural performance (A34), 0.22; risk management capacity (A35), 0.18; international image index (A41), 0.42; opening-up degree index (A42), 0.35; enterprise social responsibility index (A43), 0.23; technical input status (A51), 0.26; technical equipment status (A52), 0.25; technological innovation ability (A53), 0.30; and core technology



Fig. 1. Indexes at all levels of the international competitiveness evaluation system of Chinese railway enterprises.

(A54), 0.19. The names and weights of 66 indexes of the level 4 index (program level) are: sales revenue (A111), 0.37; total profit (A112), 0.20; net assets (A113), 0.43; return on sales (A121), 0.27; labor efficiency (A122), 0.25; return on assets (A123), 0.48; market share (A131), 0.45; production and marketing rate (A132), 0.20; price advantage (A133), 0.35; average annual increase rate of sales revenue in the past three years (A141), 0.22; average annual increase rate of sales in the past three years (A142), 0.35; average annual increase rate of market share in the past three years (A143), 0.43; current ratio (A151), 0.31; quick ratio (A152), 0.17; debt-asset ratio (A153), 0.52; proportion of employees with college degree or above (A211), 0.33; proportion of employees with senior technical title (A212), 0.67; brand reliability (A221), 0.62; social support (A222), 0.38; material resources channel (A231), 0.60; supplier bargaining power (A232), 0.40; information resources channel (A241), 0.58; information technology input ratio (A242), 0.42; land resources (A251), 0.15; traffic resources (A252), 0.65; water resources (A253), 0.20; water consumption of ten thousand yuan output value (A261), 0.31; power consumption of ten thousand yuan output value (A262), 0.34; material consumption of ten thousand yuan output value (A263), 0.35; comprehensive utilization rate of water resources (A271), 0.44; comprehensive profit margin of solid waste (A272), 0.56; strategic planning level (A311), 0.37; strategic innovation ability (A312), 0.33; strategic implementation efforts (A313), 0.30; human resources development ability (A321), 0.27; business model advancement (A322), 0.39; degree of sharing resource and information (A323), 0.34; enterprise management system integrity (A331), 0.37; enterprise management model advancement (A332), 0.22; number of international management certificates passed by the enterprise (A333), 0.41; enterprise cohesion (A341), 0.40; enterprise culture advancement (A342), 0.19; enterprise culture internationalization level (A343), 0.41; risk management organization (A351), 0.55; risk management plan (A352), 0.45; enterprise foreign-related contract performance rate (A411), 0.31; number of enterprise international litigation (A412), 0.19; international advertise and packaging investment (A413), 0.16; international rank of enterprises in the same industry (A414), 0.34; utilization rate of foreign capital (A421), 0.12; number of overseas subsidiaries (A422), 0.27; proportion of overseas employees to the total employees of enterprise (A423), 0.32; proportion of international sales to total sales (A424), 0.39; social contribution rate (A431), 0.27; social burden coefficient (A432), 0.21; enterprise environmental index (A433), 0.25; proportion of social welfare expenditure (A434), 0.27; proportion of technical research & development and technical transformation investment to sales income in the past three years (A511), 0.56; proportion of scientific research & development personnel to employees (A512), 0.44; technical equipment rate per capita (A521), 0.53; equipment newness degree coefficient (A522), 0.30; equipment utilization rate (A523), 0.17; conversion rate of scientific research achievements in recent three

years (A531), 0.35; proportion of new product sales to total sales in the past three years (A532), 0.33; number of patents (A533), 0.32; and mastery condition of core technology (A541), 1.00.

### 3 Evaluation analysis on international competitiveness of railway construction enterprises

The railway enterprises in China are mainly divided into four categories: railway operation and management enterprises, railway equipment manufacturing enterprises, railway construction enterprises, and railway design consulting enterprises. First, we analyzed the competitiveness condition of China's railway construction enterprises by taking the China Railway Construction Corporation Limited (hereinafter referred to as the "CRCC") as an example.

Compared with other enterprises, railway construction enterprises have great differences in production and business activities, and they have some notable characteristics: ① the liquidity of the production process, ② the complexity of the production process, ③ the long-term production cycle, ④ the large magnitude of value of the products, ⑤ the uniqueness of the products, ⑥ the relative irreversibility of the products, and ⑦ the large impact range of the products [4].

Six major railway construction enterprises are selected for analysis and comparison: ACS Grupo of Spain, Fluor Corp of the United States, Bechtel of the United States, VINCI of France, Hochtief AG of Germany, and the CRCC. These six enterprises are all listed companies and will publish the annual accounting reports in each fiscal year. To obtain enough data, the listed parent companies, rather than the subordinate construction departments of parent companies, of the six railway construction enterprises are selected as the evaluation objects.

For indexes unavailable for direct measurement or data measurement, the study assumes that these indexes are equal and 0.

According to the core elements of construction enterprise competitiveness, we calculated the mapping relationship between calculation results and specific scoring criteria and mapped the specific data into specific scores to obtain the evaluation results of all levels of indexes for international competitiveness of six railway construction enterprises (Table 1).

According to the overall score, the comprehensive competitiveness evaluation results of railway construction enterprises are ranked from CRCC (53), VINCI of France (51), ACS Grupo of Spain (46), Hochtief AG of Germany (46), and Bechtel of the United States (31) (the scoring results of level 2 indexes and level 3 indexes are omitted).

From the scores of level 2 indexes, the reason of why CRCC gets high score is that its score in economic index and international influence is high. Comparatively speaking, CRCC still has room for improvement in management ability and technological innovation. From the scores of the level 3 index, in the low-

er-level indexes of economic index (A1), the efficiency index and debt paying ability of CRCC need to be further improved. Overall, all indexes of CRCC in management ability have room for improvement. In addition, the opening-up degree and the status of the mastery degree of core technology still have the room for breakthrough.

#### 4 Evaluation analysis on international competitiveness of railway equipment manufacturing enterprises

This study selects six major railway equipment manufacturing enterprises in the world for analysis and comparison, namely, Bombardier of Canada, Siemens of Germany, Alsthom of France, Kawasaki of Japan, GE of the United States and CRRC. These six enterprises are all listed companies and will publish the annual accounting reports in each fiscal year. To obtain enough data, the listed parent companies, rather than the subordinate transportation departments of parent companies, of the six railway equipment manufacturing enterprises are selected as the evaluation objects.

As to the time selection of the evaluation objects, the fiscal year data in 2014 of six equipment manufacturing enterprises were selected, wherein the fiscal year of GE, CRRC, and Bombardier is from November 31, 2013 to November 31, 2014, the fiscal year of Siemens is from September 30, 2013 to September 30, 2014, and the fiscal year of Alsthom and Kawasaki is from March 31, 2014 to March 31, 2015.

We calculated the mapping relationship between calculation results and specific scoring criteria and mapped the specific data into specific scores to obtain the evaluation results of all levels of indexes for international competitiveness of six railway equipment manufacturing enterprises (Table 2).

The international comprehensive competitiveness of six equipment manufacturing enterprises is ranked from GE (45), Siemens (40), CRRC (32), Kawasaki (27), Alsthom (21), and Bombardier (20). The international competitiveness of CRRC and Kawasaki is ranked in the middle, the international competitiveness of GE and Siemens is ranked ahead, while the international competitiveness of Bombardier and Alsthom is ranked at the bottom. (The scoring results of level 2 indexes and level 3 indexes are omitted)

According to the scores of level 2 indexes, the reason why the comprehensive competitiveness of GE and Siemens gets a high score is that its economic indexes (A1) have a larger advantage, while the score of economic indexes (A1) of Alsthom and Bombardier is at the bottom.

According to the level 2 index, the technical index (A5) of CRRC has reached the world forefront; the economic index (A1), resource-based index (A2), and management index (A3) are scored in the middle and have certain room for improvement, but the international influence index (A4) of CRRC is lagging. To improve the comprehensive international competitiveness of CRRC, it is extremely necessary to improve the international influence of CRRC.

According to score of level 3 index, in the lower-level index of economic index (A1), the asset size index (A11) of CRRC needs to be improved, indicating that the asset size of CRRC still differs from that of Siemens and GE as two comprehensive industrial enterprises, but the asset size of CRRC is much larger than those of Alsthom, Bombardier, and Kawasaki. The debt paying ability (A15) of CRRC is also in a relatively backward position, indicating that the CRRC should pay attention to risk control in order to improve the comprehensive international competitiveness so that the enterprise can achieve healthy survival and development. In the lower-level index of international influence index (A4), the opening-up degree index (A42) of CRRC in China is far lower than that of other countries, indicating that we face certain problems in foreign market development.

#### 5 Policy suggestions for improving international competitiveness of China's railway enterprises

To improve the competitiveness of China's railway enterprises, the government, industry associations, enterprises, financial institutions, and research institutions need to cooperate closely to overcome the problems and challenges of China's "Go Global" railway strategy [5].

(1) Making top-level design, strengthening industrial chain coordination, and combining regional and foreign enterprises with plans and targets to build new competitive advantages and form new competitiveness.

(2) Implementing intellectual property strategy, understand-

**Table 1.** Index evaluation results for international competitiveness of construction enterprises.

|  | Spain<br>ACS Grupo | US<br>Bechtel | France<br>VINCI | Germany<br>Hochtief AG | CRCC |
|--|--------------------|---------------|-----------------|------------------------|------|
| Score of comprehensive competitiveness index | 46                 | 31            | 51              | 46                     | 53   |

**Table 2.** Index evaluation results of international comprehensive competitiveness of equipment manufacturing enterprises.

|  | Siemens | Alstom | GE | Bombardier | Kawasaki | CRRC |
|--|---------|--------|----|------------|----------|------|
| Score of comprehensive competitiveness index | 40      | 21     | 45 | 20         | 27       | 32   |

ing the claim protection scope, potential litigation, and market competition of patents deployed by the “Go Global” target countries, as well as laws and regulations of the host countries, developing intellectual property strategies with targets, managing, controlling, and eliminating these intellectual property risks.

(3) Promoting the internationalization of Chinese standards and the “sinification” of railway standards to establish a good image of the railway and the whole manufacturing industry and the country.

(4) Strengthening the management ability and integrating it into the political, cultural, legal, and religious environment to form a new state-owned assets management system based on management capital.

(5) Promoting the integration of industry-university-research, improving innovation ability, and setting up a National Railway Research Center in universities or research institutions with mature conditions to carry out the centralized researches on basic theory and key technology.

(6) Innovating the financing pattern, reducing financial risk,

and using the support from the World Bank, the Asian Development Bank, the New Development Bank, and, especially, the Asian Investment Bank and other international financial institutions to speed up “Go Global.”

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