Research on Sustainable Development Performance Evaluation of China's High End Equipment Manufacturing Enterprises

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Abstract. Based on the data of Listed Companies in China's high-end equipment manufacturing industry in 2018, this paper uses robust sparse principal component analysis (ROSPCA) method to evaluate the sustainable development performance of enterprises comprehensively. The empirical results show that in the performance evaluation of sustainable development, environmental performance is the most important, followed by business ethics performance, governance performance is the third, the fourth is social performance, and economic performance is the last. According to the conclusion of the empirical study, the paper puts forward some countermeasures, such as strengthening the environmental information disclosure, paying attention to the construction of business ethics corporate culture, improving the diligent governance effect of the board of directors, striving to practice public welfare and bear social responsibility, actively exploring the market and improving the profitability.

1. Introduction
Nowadays, China's economy is changing from high-speed growth to high-quality development. To achieve high-quality development, it is necessary to unswervingly take the road of industrial transformation and upgrading, from low added value to high added value, from extensive to intensive, and from high energy consumption and high pollution to low energy consumption and low pollution. Xi Jinping's thought of socialism with Chinese characteristics in the new era puts forward that we should firmly establish the awareness of respecting, adapting to and protecting nature, solve the contradictions brought by industrial civilization, aim at the harmonious coexistence between man and nature, realize the sustainable development of the world and the all-round development of man, advocate a green, low-carbon, circular and sustainable production and life style, take actions to deal with climate change, build an ecological system that respects and develops green, and protect the earth home on which human beings depend for survival. As the main body shouldering the heavy responsibility of industrial transformation and upgrading, it is very important for China's high-end equipment manufacturing enterprises to meet the requirements of green development in the new era, maintain the harmonious development of industry and environment and practice the mission of sustainable development. An objective, scientific and comprehensive evaluation of the sustainable development performance of China's high-end equipment manufacturing enterprises is conducive to the leading role of the concept...
of sustainable development, to promoting enterprises to fulfill their responsibilities and obligations in sustainable development, and to creating more value for the stakeholders of enterprises.

In this paper, based on the systematic review of domestic and foreign research on enterprise sustainable development performance evaluation, the index system of sustainable development performance evaluation of China's high-end equipment manufacturing enterprises is constructed based on EGSEE framework, and the sustainable development performance of enterprises is comprehensively evaluated by using robust sparse principal component analysis ROSPCA method, and some countermeasures and suggestions are put forward to improve the sustainable development performance of China's high-end equipment manufacturing enterprises. Compared with the existing research, the contribution of this paper is mainly in two aspects: First, the sustainable development performance of China's high-end equipment manufacturing enterprises is comprehensively investigated from five aspects: economy, governance, society, business ethics and environment by using EGSEE analysis framework. Secondly, the robust sparse principal component analysis (ROSPCA), which has the advantages of outlier robustness and principal component sparsity, is applied to the comprehensive evaluation of the sustainable development performance of China's high-end equipment manufacturing enterprises, which effectively resists the interference of outliers on the analysis results, and the meaning of principal components is easier to explain.

2. A Review of Research on Performance Evaluation of Sustainable Development of Enterprises at Home and Abroad

There are three main types of research related to the performance evaluation of sustainable development: the first type is the evaluation system of domestic and foreign investment institutions, such as MSCI, FTSE Russell, Thomson Reuters, KDL, Goldman Sachs, RobecoSAM, Corporate Knights, Hexun; The second category is the evaluation schemes of social organizations at home and abroad, such as CFA Institute, GRI, China Enterprise Confederation and China Business Council for Sustainable Development; The third category is the evaluation research of domestic and foreign scientific research scholars.

2.1. Evaluation system of investment institutions at home and abroad

The evaluation system of MSCI analyzes the performance of enterprises in three aspects: environment, society and governance, and FTSE Russell evaluates enterprises from three aspects: environment, society and governance. Thomson Reuters evaluated the performance of enterprises in three aspects: environment, society and governance, and KDL (Kinder, Lydenberg and Domini) evaluation system also revolves around the three aspects of enterprise environment, society and governance. Goldman Sachs' evaluation system also considers the influence of environment, society and governance, and RobecoSAM evaluates the sustainable performance of enterprises from three dimensions of economy, society and environment. The evaluation system of Corporate Knights starts from three aspects: resource management, financial management and employee management, and Hexun's evaluation system focuses on five aspects: shareholder responsibility, employee responsibility, supplier, customer and consumer rights responsibility, environmental responsibility and social responsibility.

2.2. Evaluation scheme of social organizations at home and abroad

CFA Institute listed the core factors of evaluating the sustainable development ability of listed companies in the investor handbook Environmental, Social and Governance Factors of Listed Companies published in 2008, including three aspects: environment, society and governance. GRI published the first edition of the Sustainable Development Reporting Guide in 2000 as a reference for enterprises to disclose sustainable development achievements. At present, the latest edition of the Guide is GRI Sustainable Development Reporting Standard implemented in 2018. GRI sustainable development reporting standard establishes the evaluation contents of six major themes: economy, environment, labor practice, human rights, society and product responsibility. Since 2016, China Enterprise Confederation and China Business Council for Sustainable Development have jointly carried out the research work on the sustainable development index of Chinese enterprises, and launched the "Top
100 List of Sustainable Development of Chinese Enterprises" in 2018 [1]. Its evaluation scheme consists of three dimensions: competitiveness, environment and society.

2.3. Evaluation of domestic and foreign scientific research scholars
According to the characteristics of chemical enterprises, Tao Jinguo et al. (2013) [2] designed an evaluation index system with economic sustainability, social sustainability and resource and environment sustainability as the first-class indicators. Through the questionnaire survey, the third-level index information which can reflect the second-level index content is collected, and the sustainable development ability of enterprises is comprehensively evaluated by using expert scoring and analytic hierarchy process. The evaluation index system constructed by Wu Xiaolong et al. (2016) [3] is divided into three parts: economic evaluation, social evaluation and ecological evaluation. Analytic Hierarchy Process (AHP) is selected to comprehensively analyze the indicators, and then a triple performance static harmony model is established to measure the sustainable development ability of enterprises. Marie et al. (2016) [4] compiled an evaluation system of enterprise sustainable development performance from four angles of environment, society, economy and corporate governance, and analyzed the enterprise sustainable development level by factor analysis. Tseng et al. (2017) [5] investigated the performance of enterprises in six aspects, such as economic activities, shareholder management, policy and performance, operation control, corporate culture and social image, and designed the performance evaluation index system of enterprises' sustainable development. Using DEMATEL mixed fuzzy comprehensive method, 21 secondary indicators were synthesized into comprehensive indicators of enterprises' sustainable development performance evaluation. Marius et al. (2019) [6] decomposed the enterprise sustainable development performance into two parts: enterprise environmental performance and enterprise financial performance, and comprehensively evaluated the enterprise sustainable development performance by using principal component analysis and fuzzy logic method.

2.4. Review of research at home and abroad
Domestic and foreign research on enterprise sustainable development performance evaluation has achieved considerable results, but there is still room for improvement, which provides some room for improvement for this study. First, most studies on the evaluation of sustainable development of enterprises by domestic and foreign investment institutions and Social organizations are similar to those of corporate social responsibility. The main content of the evaluation is ESG (Environmental, Social, Governance), that is, environment, society and governance. Rezai et al. (2018) [7] put forward that the evaluation system of enterprise sustainable development should cover EGSEE (Economic, Governance, Social, Ethical, Environmental), that is, economy, governance, society, business ethics and environment. Compared with ESG, EGSEE has two advantages: (1) ESG is an investment philosophy and enterprise evaluation standard that focuses on enterprise environment, society and governance performance rather than financial performance, and EGSEE incorporates economic factors that reflect enterprise financial performance. Therefore, EGSEE can evaluate the sustainable development ability of enterprises from the perspective of both non-financial performance and financial performance, and expand the extension of ESG. (2) ESG focuses on evaluating the contribution of enterprises in fulfilling their social responsibilities, and EGSEE also considers the business ethics performance of enterprises on this basis, which has richer connotations than ESG. Business ethics, which is composed of values and moral standards in business operation, is the basis and principle for the implementation of corporate social responsibility, and provides a basis for moral judgment for corporate social responsibility. Corporate social responsibility is more reflected in the externally visible behavior of enterprises, with clear objects, specific content categories and purposes. For enterprises, both business ethics and social responsibility are indispensable. Secondly, in the early days, the methods of evaluating the performance of sustainable development of enterprises at home and abroad were mainly subjective weighting methods such as expert scoring method and analytic hierarchy process. In recent studies, objective weighting methods such as factor analysis method, principal component analysis method, fuzzy logic method and DEMATEL mixed fuzzy synthesis method were used. Although these objective weighting methods can
avoid the subjective randomness of subjective weighting methods, their anti-interference ability to outliers and outliers is weak. In this paper, robust sparse principal component analysis (ROSPCA) proposed by Hubert et al. (2016) [8] is used for the first time to comprehensively evaluate the sustainable development performance of enterprises, which not only avoids the disadvantages of subjective weighting method, but also ensures the robustness of objective weighting method.

3. Construction of Performance Evaluation Index System for Sustainable Development of High-end Equipment Manufacturing Enterprises in China

3.1. Principles of constructing evaluation index system
In order to evaluate the sustainable development performance of enterprises systematically, comprehensively, objectively and scientifically, this paper follows the following principles when constructing the index system: (1) The principle of comprehensiveness. It is difficult to fully explain the sustainable development performance of enterprises with a small number of indicators. It is necessary to fully consider the five aspects of economy, governance, society, business ethics and environment, and select corresponding indicators to measure the performance of all aspects, so as to realize the evaluation of the overall performance. (2) Principle of importance. Different indicators reflect different contents and characteristics. When selecting indicators, we should consider the degree of contribution to the impact of performance, make proper priorities and choices, and concentrate on selecting indicators that directly reflect enterprise performance. (3) Representative principle. Indices are not unrelated, but organically related, and there is a certain degree of substitutability between them. Considering this relationship between indicators, we should select the representative indicators that can effectively reflect the sustainable development performance of enterprises, so as to reduce errors and improve efficiency. (4) The principle of comparability. Performance indicators should have universal applicability, and their economic content, spatial scope, time scope, calculation caliber and calculation method should be comparable. (5) The principle of feasibility. The selection of indicators should fully consider the characteristics of the evaluated object. The calculation and assignment of all indicators should make full use of the public data of the evaluated object, make an objective evaluation of the performance status of the evaluated object as far as possible, and simplify the designed indicators as much as possible, so that the indicator system is easy to operate and feasible in practice.

3.2. Evaluation index system under the framework of EGSEE
According to Rezai et al. (2018), sustainable development of enterprises can be divided into financial and non-financial performance, which can be summarized into five aspects, namely, economy (E), governance (G), society (S), business ethics (E) and environment (E). Economic performance is the most important and common aspect of sustainable development. Governance performance can protect the interests of other stakeholders. Social performance reflects the practice of transforming social goals into benefits for organizational stakeholders. Business ethics performance can play an important role in ensuring enterprises to achieve their goals and sustainable development. Environmental performance can maximize the positive impact of enterprises on natural resources and environment. According to the financial and non-financial key performance indicators related to enterprise sustainable development given by Rezai et al. (2018), according to the principles of comprehensiveness, importance, representativeness and comparability, and considering the availability of data, this paper obtains the performance evaluation index system of enterprise sustainable development, which is divided into five first-level indicators and nine second-level indicators as shown in Table 1.
### Table 1. Performance evaluation index system of enterprise sustainable development

| Primary index                  | Secondary index                  | Variable | Unit   | Explain                                                                                                                                 |
|-------------------------------|----------------------------------|----------|--------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Economic performance E        | Operating margin                 | X1       | No     | Operating gross profit margin = (operating income - operating cost) / operating income                                           |
|                               | Return on net assets             | X2       | No     | Return on net assets = net profit / owner's equity                                                                                   |
| Governance performance G      | Proportion of independent directors | X3       | No     | Proportion of independent directors to all directors                                                                                   |
|                               | Number of board meetings         | X4       | Frequency | Number of board meetings held                                                                                                      |
|                               | Board size                       | X5       | People | Number of board members                                                                                                             |
| Social performance S          | Ratio of external donations to operating income | X6       | No     | Ratio of foreign donations to operating income = foreign donations / operating income                                               |
|                               | Foreign donation                 | X7       | Million yuan | The company donates assets, including monetary assets and non-monetary assets                                                   |
| Business ethics performance E | Code of business conduct         | X8       | Article | Number of codes of business conduct listed on the company website or social responsibility report                                     |
| Environmental performance E   | Comprehensive score of environmental protection and environmental information disclosure | X9       | Points | Comprehensive score of environmental protection and environmental information disclosure: undisclosed = 0; Disclosure of relevant information = 1 point; Disclosure of basic written information = 2 points; Disclosure of detailed text information = 3 points; Disclosure of basic digital information = 4 points; Disclosure of detailed digital information = 5 points |

4. **ROSPCA Method for Sustainable Development Performance Evaluation of High-end Equipment Manufacturing Enterprises in China**

Hubert et al. (2005) [9] combined projection pursuit and MCD estimator, proposed a robust PCA algorithm, which can draw the diagnosis map of robust principal components and effectively distinguish the normal observed values from the abnormal values of principal components. On the basis of ROBPCA method, Hubert et al. (2016) put forward robust sparse principal component analysis (ROSPCA), which combines ROBPCA with sparse principal component analysis SCoTLASS[10]. Its robust performance effectively avoids the interference caused by outliers and extreme values, and its
sparse performance ensures that important explanatory variables have a large load, and the load of variables that contribute little is close to zero. Ruan Haolin and Wang Binhui (2020)[11] think that ROSPCA method will make the meaning of principal components clear, which is very beneficial to the comprehensive evaluation. ROSPCA method is mainly divided into three steps: robust standardization, robust sparse principal component analysis and calculation of robust sparse principal component score.

4.1. Robust standardization
ROSCA method contains two super parameters $\alpha$ and $\lambda$. $\alpha$ determines the degree of robustness and $\lambda$ controls sparsity. The value of $\alpha$ must meet $0.5 \leq \alpha < 1$, which needs to be determined in advance. It determines the lower limit of the number of normal observations, and at most $(1-\alpha)$ data in $n$ observations is allowed to be abnormal. $\alpha$ is usually 0.75, and the sparsity parameter $\lambda$ can be determined by BIC criterion.

Firstly, the variables are subjected to robust standardization, then the obtained data matrix is subjected to singular value decomposition, and the $P$-dimensional data space is reduced to $n$ affine subspaces with observed values, and the obtained data matrix is denoted as $\tilde{X}$. Then, for each $\tilde{x}_i$, the Stahel-Donoho isolation degree is calculated by formula (1):

$\text{outl}(\tilde{x}_i) = \max_{v \in B} \frac{|\tilde{x}_i^Tv - \hat{\mu}_{MCD}(\tilde{x}_i^Tv)|}{\hat{\sigma}_{MCD}(\tilde{x}_i^Tv)}$ (1)

In formula (1), $\hat{\mu}_{MCD}$ and $\hat{\sigma}_{MCD}$ are MCD estimators of position and scale respectively, set $B$ is composed of all directions $v$ passing through two observation points, and the appropriate value of principal component number $k$ can be determined by gravel map or cumulative variance contribution rate.

4.2. Robust sparse principal component analysis
Unlike ROBPCA, which applies the traditional principal component analysis method to the observed value of $H_1$, ROSPCA adopts the sparse principal component analysis method. Firstly, the data points of $X$ are standardized robustly, and the sparse principal component analysis is carried out by SCoTLASS method with sparse parameter $\lambda$, and the sparse load matrix $P_1 \in \mathbb{R}^{p \times k}$ is obtained. Then, an extra weighting step is adopted to consider the information of data sparse structure, and the bridge between sparse components and robust components in the algorithm is built to improve the effectiveness. Without considering the variables with zero load for all $k$ principal components, the estimated orthogonal distance of sparse principal component analysis subspace is calculated, and the set $H_2$ with orthogonal distance less than the critical value is obtained. The subset $X$ of $H_2$ is normalized by the median of $H_1$ and $Q_{1\alpha}$, and the sparse principal component analysis is performed by SCoTLASS method with sparse parameter $\lambda$ again. In order to obtain the complete load matrix $P_2$, it is necessary to add zero row vectors to the abandoned variables in the estimated load matrix. The $k$-dimensional principal component score $T$ is $T = (X - \bar{\mu}) \hat{\mu}_i^T P_2$, where $\bar{\mu}_i$ is the median of $H_1$ observations. The purpose of re-weighting is to recapture the information that only variables that are not important to the model are abnormal, and then use this information to obtain better load estimation for important variables.
4.3. Calculate the robust sparse principal component score

Finally, the robust estimation of eigenvalues will be obtained from the $Q_n^2$ estimator of the observed value of $H_2$. Since the observed values with low orthogonal distance OD and high score distance SD will affect the estimation of eigenvalues, it is necessary to use robust estimation of scales. In order to estimate the center robustly, the score distance is calculated and then all the observed values in $H_2$ whose score distance is less than the corresponding critical value are observed, forming a set $H_3$. Then, the center value is estimated according to the mean value of these observations, and the final center $\hat{\mu}$ and final score $T = (X - \hat{\mu})P$ are obtained. The eigenvalues are re-estimated by the sample variance of the new score of the observations in $H_3$.

5. An Empirical Study on Sustainable Development Performance Evaluation of High-end Equipment Manufacturing Enterprises in China

5.1. Sample selection and data source

According to the requirements of "Made in China 2025", the action program for the first decade of China's strategy of manufacturing a strong country, ten advantageous and strategic industries, including seven categories: high-grade CNC machine tools and robots, aerospace equipment, offshore engineering equipment and high-tech ships, advanced rail transit equipment, energy-saving and new-energy vehicles, power equipment and agricultural machinery equipment, will become the key areas of development during the 13th Five-Year Plan and the 14th Five-Year Plan. This paper holds that these seven categories are all in line with the characteristics of high-end equipment manufacturing industry, which is a high-end machinery and equipment manufacturing industry with high-tech in many fields, complex and advanced equipment, huge product functions and high value chain and core position of industrial chain. Therefore, the sample enterprises selected in this study are composed of A-share listed companies belonging to these seven industries. Delete the companies that have been ST, *ST, PT, or have major business problems during the period, and screen according to the business scope and main product introduction of listed companies, and finally retain 53 high-end equipment manufacturing listed companies that issued corporate social responsibility reports or sustainable development reports in 2018, including: There are 2 high-grade CNC machine tools and robots, 6 aerospace equipment, 10 offshore engineering equipment and high-tech ships, 4 advanced rail transit equipment, 12 energy-saving and new energy vehicles, 18 power equipment and 1 agricultural machinery equipment.

The data selected in this paper belongs to 2018. The gross profit margin, return on net assets and the number of board meetings come from Guotai'an database, while the proportion of independent directors and the number of board members come from Ruisi database. The ratio of foreign donations to operating income, foreign donations come from the IFIND database, and the comprehensive scores of business conduct standards, environmental protection and environmental information disclosure are compiled according to the corporate social responsibility report and sustainable development report issued by listed companies.

5.2. Empirical analysis results

Superparameters $\alpha$ and $\lambda$ need to be determined before robust sparse principal component using ROSPCA. As $\alpha$ determines the lower limit of the number of normal observations, it should not be too small, but should meet $0.5 \leq \alpha < 1$. In this paper, $\alpha$ is taken as the usual 0.75. Sparsity parameter $\lambda$ is determined by BIC criterion. As shown in Figure 1, BIC is calculated iteratively with different $\lambda$ values from 0 to 2. When $\lambda = 0.88$, BIC reaches the minimum value, so $\lambda$ is 0.88.
The number of robust sparse principal components is determined by the cumulative variance contribution rate. The empirical results of this paper show that the cumulative variance contribution rate of the top five robust sparse principal components (PC1, PC2, PC3, PC4 and PC5) reaches 99.74%, which has a good explanatory power, and its load matrix is shown in Table 2.

**Table 2. Load matrix**

|                       | PC1        | PC2        | PC3        | PC4        | PC5        |
|-----------------------|------------|------------|------------|------------|------------|
| Operating margin X1   | $3.60 \times 10^{-22}$ | $3.59 \times 10^{-17}$ | $3.60 \times 10^{-22}$ | -          | $1.36 \times 10^{-18}$ |
| Return on net assets X2| $4.16 \times 10^{-23}$ | $8.39 \times 10^{-18}$ | -          | -          | $1.36 \times 10^{-18}$ |
| Proportion of independent directors X3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Number of board meetings X4 | $6.58 \times 10^{-44}$ | $3.99 \times 10^{-25}$ | 1.00 | $4.42 \times 10^{-17}$ | $4.16 \times 10^{-23}$ |
| Board size X5         | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Ratio of external donations to operating income X6 | $5.53 \times 10^{-39}$ | $7.32 \times 10^{-10}$ | $5.38 \times 10^{-16}$ | 0.16 | $2.09 \times 10^{-17}$ |
| Foreign donation X7   | $4.34 \times 10^{-40}$ | $1.16 \times 10^{-10}$ | $4.22 \times 10^{-17}$ | 0.99 | $1.64 \times 10^{-18}$ |
| Code of business conduct X8 | $6.58 \times 10^{-44}$ | 1.00 | $2.96 \times 10^{-31}$ | $8.58 \times 10^{-17}$ | -          |
| Comprehensive score of environmental protection and environmental information disclosure X9 | 1.00 | $1.33 \times 10^{-38}$ | $6.58 \times 10^{-44}$ | 0.00 | $4.16 \times 10^{-23}$ |

It can be seen from Table 2 that ROSPCA gives full play to its advantages, reducing the load of irrelevant variables in each principal component to approximately zero, and the economic meaning of the five principal components obtained is very clear. PC1=X9, reflecting the environmental performance of enterprises; PC2=X8, which reflects the business ethics performance of enterprises; PC3=X4, reflecting the corporate governance performance; PC4=0.16X6+0.99X7, reflecting the social...
performance of enterprises; \( PC_5 = 0.23X_1 + 0.97X_2 \), which reflects the economic performance of enterprises. Furthermore, the comprehensive score of sustainable development performance of each enterprise is calculated from five principal component scores, and the top ten enterprises are shown in Table 3.

Table 3. In 2018, China's high-end equipment manufacturing enterprises scored the top ten comprehensive scores for sustainable development performance

| Ranking | Enterprise | Comprehensive score | Industry | Provinces and cities | Area | Type of economy |
|---------|------------|---------------------|----------|----------------------|------|-----------------|
| 1       | Shanghai Electric | 8.63 | Electric power equipment | Shanghai | Eastern region | Local state-owned enterprises |
| 2       | CRRC Corporation Limited | 8.16 | Advanced rail transit equipment | Beijing | Eastern region | Central state-owned enterprises |
| 3       | DEC | 7.88 | Electric power equipment | Sichuan | Western region | Local state-owned enterprises |
| 4       | SAIC Motor Corporation Limited | 6.84 | Energy saving and new energy vehicles | Shanghai | Eastern region | Central state-owned enterprises |
| 5       | Dongfeng Motor Corporation | 6.60 | Energy saving and new energy vehicles | Hubei | midland | Local state-owned enterprises |
| 6       | BYD | 6.51 | Energy saving and new energy vehicles | Guangdong | Eastern region | Private enterprise |
| 7       | Guangzhou Automobile Group Co., Ltd. | 6.04 | Energy saving and new energy vehicles | Guangdong | Eastern region | Local state-owned enterprises |
| 8       | Shantui Construction Machinery Co., Ltd. | 5.45 | Offshore engineering equipment and high-tech ships | Shandong | Eastern region | Local state-owned enterprises |
| 9       | China Shipbuilding marine and defense equipment Co., Ltd. | 5.26 | Offshore engineering equipment and high-tech ships | Guangdong | Eastern region | Central state-owned enterprises |
| 10      | First Tractor Company Limited | 4.94 | Agricultural machinery equipment | Henan | Midland | Central state-owned enterprises |
It can be seen from Table 3 that among the 53 high-end equipment manufacturing listed companies that issued corporate social responsibility reports or sustainable development reports in 2018, the top ten enterprises have the following characteristics: First, from the perspective of industry distribution, the top ten enterprises come from five industries: power equipment, advanced rail transit equipment, energy-saving and new energy vehicles, offshore engineering equipment and high-tech ships, agricultural machinery and equipment; Second, from the perspective of geographical distribution, 70% of the top ten enterprises come from the eastern region, and are mainly concentrated in Guangdong, Shanghai, Beijing and other places; Third, in terms of economic types, half of the top ten enterprises are central state-owned enterprises, and the fourth is local state-owned enterprises.

6. Countermeasures to Improve the Sustainable Development Performance of China's High-end Equipment Manufacturing Enterprises

The empirical study in this paper shows that the objective division results obtained by robust sparse principal component analysis are highly consistent with the design of evaluation index system, and the sustainable development performance of China's high-end equipment manufacturing enterprises consists of five parts. Among them, environmental performance is the most important, followed by business ethics performance, governance performance ranks third, social performance ranks fourth, and economic performance ranks last. We can comprehensively improve the sustainable development performance of China's high-end equipment manufacturing enterprises from these five aspects:

(1) Strengthen the standardization of environmental information disclosure. According to the Evaluation Report on Environmental Responsibility Information Disclosure of Listed Companies in China (2018) jointly issued by the China Forum of Environmental Journalists and Beijing University of Chemical Technology, there are 928 valid sample companies that have published relevant environmental responsibility reports, social responsibility reports and sustainable development reports in 2018, accounting for 26.02% of the total number of listed companies in Shanghai and Shenzhen stock markets. The research of this paper found that in 2018, 29.78% of high-end equipment manufacturing listed companies in Shanghai and Shenzhen stock markets released reports related to environmental information, which was slightly higher than the overall level of listed companies. However, less than half of these companies could disclose energy consumption and emission data in detail, and many companies only made qualitative descriptions in words, lacking quantitative data. Moreover, the disclosure standards of listed companies that disclose environmental responsibility information are not uniform. For example, some companies disclose comprehensive energy consumption, while others disclose energy consumption per unit output value; Some companies disclose the emissions of waste gas, waste water and waste residue, while others announce the emissions of greenhouse gases. Environmental performance is the most important part of the sustainable development performance of China's high-end equipment manufacturing enterprises. It is urgent to further enhance the awareness of environmental safety responsibility of enterprises by compulsory disclosure of environmental information and unification of energy consumption and emission standards.

(2) Pay attention to the construction of business ethics and corporate culture. Business ethics is the moral criterion and standard guiding the production and operation behavior of high-end equipment manufacturing enterprises, and it is the collective value of enterprise organization. The construction of business ethics and corporate culture can ease internal conflicts, maintain good public relations and reduce legal responsibilities. Some high-end equipment manufacturing enterprises have formed a set of high-quality, profound and innovative business ethics system through hard exploration, for example, Shanghai Electric's "pioneering", "meticulous, striving for perfection", "pole motor", "10,000 tons", "ants gnawing bones" enterprise spirit, and Dongfeng Motor's "harmony" culture, "run" plan and "business ethics convention". However, the business ethics of some high-end equipment manufacturing enterprises are either mere formality, empty slogans or lack of characteristics, which is not conducive to the implementation of corporate culture. Business ethics performance is the second most important part of the sustainable development performance of China's high-end equipment manufacturing enterprises. It is suggested to create a "people-oriented" enterprise atmosphere and implement a
management system of "governing by culture" to shape a set of business ethics system with distinctive characteristics and fruitful performance.

(3) Enhance the diligent governance effect of the board of directors. Board meetings are the platform for the board to perform its duties. Board members express their opinions and discuss in the form of meetings, and play a supervisory role. The number of board meetings can measure the diligence of the board. The more diligent the board of directors is, the more helpful it is to perform its duties and improve the company's performance. Compared with adjusting the composition of the board of directors or the ownership structure of enterprises, adjusting the frequency of board meetings is easier to operate and costs less. Diligence of the board of directors will more effectively promote the production and operation of high-end equipment manufacturing enterprises, improve the quality of information disclosure and enhance the long-term sustainable development performance of enterprises. In order to promote the diligence of the board of directors to produce more effective governance effect, the board of directors can improve it by focusing on the blind spots of the executive level, and concentrate on strategies to overcome key challenges.

(4) Strive to practice public welfare and shoulder social responsibility. High-end equipment manufacturing industry is the engine to promote economic transformation and upgrading, and it is also obligatory to assume social responsibility. Enterprises strive to practice social welfare, which is conducive to enhancing the reputation of enterprises and obtaining better market performance. For example, high-end equipment manufacturing enterprises can actively participate in poverty alleviation work of the Party and the state, and take industrial poverty alleviation, intellectual poverty alleviation, employment poverty alleviation and e-commerce poverty alleviation as carriers to drive partners, suppliers, distributors, logistics enterprises and customers to implement precise poverty alleviation strategies, participate in poverty alleviation and build a poverty alleviation system for enterprises in the whole value chain. For example, high-end equipment manufacturing enterprises can make donations and materials to fight against the novel coronavirus epidemic, showing their responsibility and helping the epidemic prevention struggle.

(5) Actively explore the market and improve the profitability. High-end equipment manufacturing industry should make use of high-end manufacturing to maintain industrial advantages, actively expand overseas markets, seize the high-end market position of industrial chain in the new round of international division of labor, and improve profitability. For example, on March 11, 2020, Dongfang Steam Turbine Co., Ltd. of Dongfang Electric Group officially signed a procurement contract for 18 sets of 150MW steam turbines and auxiliary equipment in the second phase project of Indonesia Bintan Nanshan Industrial Park Thermal Power Company, which has played a leading technical advantage and mature experience in the small and medium-sized primary reheat steam turbine market for a long time, helping the development of industrial parks in overseas markets with high-quality products and driving the common prosperity of countries along the "the belt and road initiative" with green power. In recent years, the frequent friction between China and the United States around strategic emerging industries has become a major uncertain factor in the development of China's high-end equipment manufacturing industry. However, in the long run, with the continuous release of industrial policy dividends and the vigorous development of new technologies, new formats and new models, China's high-end equipment manufacturing enterprises have broad prospects for future development.

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