Comprehensive performance evaluation of Chinese nuclear power listed companies based on HSE perspective

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Abstract. Safe development has always been China's most basic requirement for nuclear power companies. As China's economy has entered the stage of high-quality development, research on the sustainable development of the nuclear power industry is still necessary. From the perspective of HSE, the article constructs an innovative system, which reflects the financial status, industry characteristics, and HSE performance of nuclear power enterprises. After taking 56 Chinese nuclear power listed companies as samples, analytic hierarchy process is used to determine the weight of index, the power coefficient method and the comprehensive analysis and judgment method is used to determine the score, which all contribute to comprehensive performance evaluation. Final research shows that financial performance is the main factor affecting the comprehensive performance of listed nuclear power companies, while HSE performance and innovation performance should be considered to improve their overall performance in the future. At the same time, suggestions for the government and energy industries are put forward.

1. Introduction
Since 1972, the international community's pace in environmental protection has never stopped. As a responsible country, China's development pace should be consistent with international goals. After the 19th National Congress of the Communist Party of China, building a modernized world is clearly stated, in which people and nature harmoniously coexist. But for a long time, China has formed a coal-fired thermal power generation structure. As China's economy gradually moves towards the stage of high-quality development, the amount of fossil energy it consumes will surely increase. In addition, some of China's energy depends on foreign imports. It is necessary to change energy consumption structure for China. As the cleanest energy source at present, nuclear power has the advantages of small radiation, low carbon emissions, and flexible plant sites. It can also overcome the shortcomings of high hydropower costs, susceptibility to wind power, high solar power production costs, and light pollution, which shows its potential for China's energy transition.

China has advocated "Safe and efficient development of nuclear power" for a long time. Especially after the nuclear accident in Fukushima, Japan in 2012, China immediately issued the "Four Opinions of the State Council on the Development of Nuclear Power" to ensure safety of all nuclear power plants in operation and under construction, and adopted a series of nuclear plans, such as "Nuclear Safety Plan", "Nuclear Power Safety Plan", "Medium and Long-term Development Plan for Nuclear Power". In recent years, China has always practiced the safe and efficient development of nuclear power. According to the 2018 State of the Environment Bulletin, no abnormal nuclear radiation was found in China.

From the perspective of the industry chain, nuclear resource fuel companies can easily cause
pollution to the surrounding environment and the atmosphere during the production and operation of uranium resources and related mineral resources. Equipment quality problems of nuclear power plant construction equipment manufacturing companies determine whether nuclear power plants can operate safely. Especially, there is a risk of nuclear leakage in every production link of a nuclear power plant operating company. Therefore, operations of all nuclear power-related companies is related to health, safety, and environment, which is consistent with HSE management system.

At the same time, foreign countries have entered the stage of innovative performance evaluation, while China has entered the stage of comprehensive performance evaluation, mainly referring to the "Implementation Rules for Performance Evaluation of Central Enterprises(IRPECE)", staying at the financial level, and without integrating the characteristics of the industry.

2. Literature review

2.1. HSE management system
The HSE Management System was first proposed by Edward Deming, an American quality management expert. Because it has the advantages of identifying and judging possible risk factors in advance, targeted prevention and control of existing dangers in the event, and reducing the incidence of accidents after the event, it has been widely used by the global petroleum industry as a comprehensive quality management model.

At present, the application of the HSE management system in the nuclear power industry is mainly focused on specific projects and countermeasures, and performance evaluation studies are scarce. On nuclear power projects, the AP1000 nuclear power project construction site uses HSE visual management[1]. Hainan Changjiang nuclear power site promotes the working environment to ensure the safety and health of workers through HSE standardization practices such as site planning, safety protection, fire protection, and emergency management[5]. Jiangxi Pengze Nuclear Power Project used HSE management system for practical operation in early stage[3]. Zheng Yining put forward suggestions for optimizing the safety system of the AP nuclear power project by comparing the HSE management systems at home and abroad[4]. In the countermeasure study, Zhu Hengzheng combined the domestic HSE management experience of related construction projects with the actual situation of the nuclear power project site HSE system, and explored the completion of the construction contractor HSE to improve HSE management level[5]. Wang Pingchun created a HSE early warning mechanism for the construction of the CAP1400 nuclear power project to ensure that construction sites take timely and targeted precautionary measures to reduce accidents[6].

However, is it feasible to study the performance evaluation of nuclear power companies from the perspective of HSE? First, the most direct motivation for them is human resources, that is, employees. Taking into account that nuclear radiation will inevitably be generated in the production process, whether the interests of employees can be ensured is the key to the operation of nuclear power enterprises. Otherwise, they will lose a lot of human resources and R&D talents. Secondly, ensuring safety is essential to the development of the nuclear power industry, because the radioactive material produced will be transmitted to various parts of the world through various means such as the atmosphere and water during production. Therefore, paying attention to nuclear safety is responsible for the safety of people's lives. Finally, considering that nuclear power companies will generate a large amount of long-lasting, large-scale radioactive materials from the collection of ore and fuel extraction to nuclear power generation, they still have the responsibility to protect the environment. Therefore, the HSE perspective is in line with the characteristics of the nuclear power industry and reflects the situation of enterprises in employee health, safety and environmental protection.

2.2. Performance related literature
The concept of performance originates from the United States. Some scholars believe that performance is the result of work, others believe that performance is the behavior of employees or organizations. Performance evaluation is to improve the performance of the organization or employees by confirming
the results and behaviors. There are two main types of performance evaluation: financial performance evaluation and comprehensive performance evaluation. Financial performance evaluation is the most important part of performance evaluation, and is used to evaluate the organization's financial completion in a certain period through a series of financial indicators, such as profitability, operations, debt and development. Comprehensive performance contains financial and non-financial aspects, and non-financial parts can be evaluated quantitatively or directly qualitatively.

At present, foreign countries have entered the stage of innovation performance evaluation. However, China is still at the stage of comprehensive performance evaluation and mainly refers to IRPECE, which involves qualitative evaluation of innovation, industry impact, and social contribution. In addition, the setting of indicators doesn’t reflect the characteristics of the industry.

From the content of performance evaluation, foreign researchers have shifted their focus from financial performance information to non-financial performance information, which can be seen from the indicators such as innovation, operations, competition, and customers[7], the ability of enterprise resource allocation[8], social responsibility[9], sustainable indicators[10]. However, Chinese researchers have gradually focused on the integration of financial and non-financial information, which is useful for reflecting the overall situation of the enterprise. They evaluated the financial performance of colleges by introducing non-financial indicators[11], proposed intellectual capital[12], paid attention to the supply chain environment[13], comprehensively considered manpower, technology, management, relationships[14], and combined financial indicators with non-financial indicators such as market share and technical personnel[15].

2.3. Related literature of new energy industry

Given that nuclear power belongs to the new energy industry, their performance must reflect the industry's technology-intensive characteristics. Scholars found that research and development investment can improve performance[16], technology is the driving force of new energy listed companies[17], and R&D investment can promote innovation performance[18], which provide theoretical support for the introduction of innovative performance later. In addition, the existing new energy companies focus on inputs and outputs in terms of R&D capabilities. For example, indicators such as R&D investment, the ratio of human capital expenses of R&D personnel to the total new employees' contributions, proportion of R&D funds to main business income, new product development cycle efficiency[19], R&D staff ratio[20], R&D staff input intensity[21] have been used to measure R&D investment. Indicators such as technology patent grant rate, technology stock ratio[22], enterprise patent applications[23], number of patents, number of papers published, high-tech revenue growth rate, high-tech income as a percentage of total income revenue[24], number of original papers[25], and growth rate of intangible assets[26] have been used to measure R&D expenditure.

3. System construction

From literature review, we know that performance evaluation has entered the stage of innovation and comprehensive performance evaluation, focusing on the combination of financial and non-financial information. Therefore, performance evaluation of nuclear power here must not only conform to the forefront of theory, but also integrate the characteristics of the industry.

3.1. Financial performance

In China, nuclear power is strictly controlled by the government, and related data is difficult to obtain. Therefore, it is very difficult to establish system of nuclear power performance evaluation. Considering the importance of financial performance, the system must contain financial part, and mainly refers to IRPECE. At the same time, due to the tedious and repetitive indicators set in rules, DuPont analysis system is used to overcome shortcomings by only using the three indicators of net sales margin, total asset turnover rate, and equity multiplier to measure corporate profit, operations, and financial conditions.
3.2. Innovation performance
As the part of the new energy industry, nuclear power companies enjoy the security guarantee provided by strong R&D capabilities and a large number of innovative talents, which means innovation performance is indispensable in the evaluation. However, Chinese nuclear power companies still have weak core technology capabilities and relatively few patent applications comparing with foreign companies. Therefore, the R&D capabilities can only be measured by the net growth rate of intangible assets and the rate of R&D technology investment. Studies have confirmed that there is a positive correlation between corporate performance and intangible assets [28]. Moreover, given R&D talents have the ability to find and solve problems, the ratio of R&D personnel is included in innovation performance, which is measured by the ratio of R&D personnel to the total number of enterprises.

3.3. HSE performance
From reading annual reports and social responsibility reports of 56 nuclear power listed companies in China from 2008 to 2018, we found that most listed nuclear power companies lack data in terms of employee health, safety and environmental protection. Although some of them include relevant data in their annual reports, they cannot avoid the disadvantages of inconsistent units and different forms of disclosure. Therefore, HSE performance can only be measured through its meaning by qualitative analysis such as the regular organization of the employees' physical examination, the degree of safety in production, and the degree of energy saving and emission reduction.

In summary, the comprehensive performance evaluation system of Chinese listed nuclear power companies based on the HSE perspective is shown in Figure 1.

![System construction](image)

Figure 1. System construction.

4. Empirical analysis
4.1. Sample selection
According to the disclosure of nuclear power concept stocks by East Money in 2017-2018, a total of 69 listed nuclear power companies were initially counted. Then, 37 are listed on the Shenzhen Stock Exchange and 32 are listed on the Shanghai Stock Exchange, accounting for 53.6% and 46.4% respectively. In addition, the selected sample companies have the following characteristics:
- Complete and no missing financial data;
• Companies that are in good financial condition and have not been ST-labeled on Shenzhen and Shanghai Exchanges within three years, such as companies with stock codes of 601106, 000922, 002248, 000629, 600202;
• No differences in accounting policies, no B-share or H-share companies, such as B-share companies with stock codes of 600835, 600848; H-share companies with stock codes of 02302, 00355, 01164, 001133, 01816, 00611.

Finally, there were 56 remaining sample companies.

4.2. Data processing
The analytic hierarchy process originated from Saty assisting the US Department of Defense to solve the confusion of the contribution of various industrial sectors to the national welfare [28]. Due to layered and organized goals, it is an effective method to determine the importance of different indicators relative to the overall goal and suitable for problems that are difficult to solve in a quantitative manner. Earlier, researchers mostly used it in the performance evaluation of new energy power. For example, Chatzimouratids used it to determine the index weights of several types of power plants [29]. Mamlook used it to make a pairwise comparison of the evaluation indicators in the solar system in Jordan, and found that the revenue indicators focus on reliability and the cost indicators focus on maintenance costs [30]. Akash and Mohsen applied it to determine index weights in power plants and solar water heating systems [31][32]. Because listed nuclear power companies are part of the new energy industry and HSE performance uses qualitative analysis, they can use AHP to determine index weights.

4.2.1. Expert rating. The analytic hierarchy process mainly refers to Saty's 9-level scale. The participants are experts and scholars studying nuclear power companies, managers of new energy companies, and teachers and students of universities. They refer to the 9-level scale to give the importance of pairwise indicators among the 9 indicators in the system, and feedback through a questionnaire. A total of 25 questionnaires were distributed in questionnaire, and 20 were finally recovered. The effective rate was 80%, which can be used for the research.

| Calculation object | Formula |
|--------------------|---------|
| Matrix | Δ = \sqrt[k]{\sum \frac{a_{ij}}{a_{ij}}} |
| Judgment matrix | ω = \frac{\Delta}{\lambda_{max}} |
| Relative weight | λ_{max} = \frac{\sum(C_{ij} \times w_j)}{\sum i} |
| Maximum eigenvalue of judgment matrix | CI = \frac{\lambda_{max} - n}{n - 1} |
| Checking for logic errors | CR = \frac{CI}{RI} |

4.2.2. Determine the weight. First, combined with expert evaluation opinions, a judgment matrix C = [c_{ij}]_{n×n} is obtained, and then the corresponding index weights are determined according to the AHP normalization method(Table 1). Generally, the more important the indicator, the greater the weight. In order to avoid logic errors, CI / CR consistency check should be performed. Generally, when CI / CR = 0, the judgment matrix has complete consistency. When CI / CR <0, the judgment matrix has basic consistency. Otherwise, experts need to re-score and construct the matrix.

After sorting out the questionnaires of 20 experts and scholars, the judgment matrix of the criterion layer (Table 2) and the index layer (Table 3, Table 4, Table 5) were obtained. W is the weight index. Since CI and CR are less than 0.1, each layer has passed the consistency check.

Finally, all indicator weight can be obtained by multiplying the corresponding lower-layer weights with the upper-layer weights(Table 6).
Table 2. Criterion layer judgment matrix.

|        | A1 | B1 | B2 | B3 | W  | AW (AW) i/ wi |
|--------|----|----|----|----|----|---------------|
| Financial performance | 1  | 5  | 3  | 65 | 1.995 | 3.029 |
| B1     |    | 86 |    |    |    | $\lambda_{max}=3.029$ |
| Innovation performance | 0.6586 | 0.6370 | 0.7306 | 0.6370 | 0.6370 |
| B2     | 0.4195 | 0.1047 | 0.0140 | 0.0140 | 0.0140 |
| HSE performance | 0.5609 | 0.6370 | 0.7306 | 0.6370 | 0.6370 |
| B3     |    | 3.029 |    |    |    | $\lambda_{max}=3.029$ |

Table 3. Indicator layer—judgement matrix of financial indicators.

|        | B1 | C1 | C2 | C3 | W  | AW (AW) i/ wi |
|--------|----|----|----|----|----|---------------|
| Sales margin | 0.6370 | 1.93 | 3.0385 |
| C1     |    | 0.55 |    |    |    | $\lambda_{max}=3.0385$ |
| Asset turnover | 0.1047 | 0.31 | 3.0385 |
| C2     | 2  | 3  | 7  | 82 |    | $\lambda_{max}=3.0385$ |
| Equity multiplier | 0.258 | 0.78 | 3.0385 |
| C3     |    | 2  |    |    |    | $\lambda_{max}=3.0385$ |

Table 4. Indicator layer—judgement matrix for innovation indicators.

|        | B2 | C  | C  | C  | W  | AW (AW) i/ wi |
|--------|----|----|----|----|----|---------------|
| Growth rate of net intangible assets | 0.57 | 0.57 | 3.064 |
| C4     | 0.884 | 0.74 | 9  |    |    | $\lambda_{max}=3.0649$ |
| Proportion of R&D technology investment | 0.223 | 0.223 | 3.064 |
| C5     | 0.306 | 0.94 | 9  |    |    | $\lambda_{max}=3.0649$ |
| Proportion of R&D personnel | 0.24 | 0.24 | 3.064 |
| C6     | 0.810 | 0.81 | 9  |    |    | $\lambda_{max}=3.0649$ |

Table 5. Indicator layer—HSE indicator judgment matrix.

|        | B3 | C  | C  | C  | W  | AW (AW) i/ wi |
|--------|----|----|----|----|----|---------------|
| Examination of employees | 0.10 | 0.10 | 3.038 |
| C7     | 0.31 | 0.31 | 3.038 |
| Degree of investment in production safety | 0.25 | 0.25 | 3.038 |
| C8     | 0.38 | 0.38 | 3.038 |
| Degree of energy saving and emission reduction | 0.63 | 0.63 | 3.038 |
| C9     | 0.93 | 0.93 | 3.038 |

Table 6. Weights of indicators at the general level.

| Target layer | Criterion layer | Criterion layer weight | Sub-factor layer | Sub-factor layer weight | Final weight |
|--------------|-----------------|------------------------|------------------|------------------------|--------------|
| A            | B1              | 0.6586                 | Net sales margin C1 | 0.6370                 | 0.4195       |
|              | B2              | 0.1562                 | Asset turnover C2  | 0.1047                 | 0.0690       |
|              | B3              | 0.1852                 | Equity multiplier C3 | 0.2583                 | 0.1701       |
|              |                 |                        | Growth rate of net intangible assets C4 | 0.1884                 | 0.0294       |
|              |                 |                        | Proportion of R&D technology investment C5 | 0.7306                 | 0.1141       |
|              |                 |                        | Proportion of R&D personnel C6 | 0.0810                 | 0.0127       |
|              |                 |                        | Regular medical examination of employees C7 | 0.1047                 | 0.0194       |
|              |                 |                        | Degree of investment in production safety C8 | 0.2583                 | 0.0478       |
|              |                 |                        | Energy saving and emission reduction C9 | 0.6370                 | 0.1180       |

4.3. Overall score

According to the IRPECE, the quantitative scores are calculated by the power factor method, and the qualitative scores are counted by comprehensive analysis and judgment.

In addition, the quantitative indicators are financial and innovation indicators here. Therefore, the financial indicators are determined by the evaluation standards for the financial indicators of the nuclear power industry issued by the SASAC in 2018 (Table 7), and the standard value of the innovation
indicator is determined by experts and scholars because of undisclosed related information (Table 8).

Finally, the final score of listed nuclear power companies can be obtained by adding up the quantitative and qualitative scores. At the same time, the evaluation types and levels of sample companies can be obtained by referring to the SASAC’s comprehensive performance evaluation grading standards (Table 9).

Table 7. Industry standards for financial indicators.

| Indicator name          | Excellent | Good  | Average | Lower   | Worse   |
|-------------------------|-----------|-------|---------|---------|---------|
| Sales margin (%)        | 9.1       | 7.55  | 5.7     | -1.05   | -12.6   |
| Asset turnover (%)      | 0.5       | 0.4   | 0.3     | 0.2     | 0.1     |
| Equity multiplier       | 6.67      | 3.33  | 2.5     | 2.22    | 2       |

Table 8. Industry standards for innovation indicators.

| Indicator name                          | Excellent | Good  | Average | Lower   | Worse   |
|-----------------------------------------|-----------|-------|---------|---------|---------|
| Growth rate of intangible assets (%)    | 131       | 104.8 | 78.6    | 52.4    | -69.52  |
| Proportion of R&D technology investment (%) | 46       | 36.7  | 16.43   | 6.5     | 0.01    |
| Percentage of researchers (%)           | 40        | 32    | 24      | 16      | 1.39    |

Table 9. Scoring results.

| Stock code | Overall rating | Score rating | Ranking | Stock code | Overall rating | Score rating | Ranking | Stock code | Overall rating | Score rating | Ranking |
|------------|----------------|--------------|---------|------------|----------------|--------------|---------|------------|----------------|--------------|---------|
| 002575     | -24            | E            | 39      | 002167     | 39             | E            | 29      | 603169     | 53             | C-           | 18      |
| 500004     | 21             | E            | 38      | 000777     | 40             | D            | 28      | 002057     | 53             | C-           | 17      |
| 002088     | 29             | E            | 37      | 000875     | 41             | D            | 27      | 000675     | 54             | C-           | 16      |
| 600558     | 29             | E            | 37      | 600456     | 42             | D            | 26      | 002438     | 55             | C-           | 15      |
| 600744     | 30             | E            | 36      | 600550     | 44             | D            | 25      | 600875     | 56             | C-           | 14      |
| 002227     | 31             | E            | 35      | 000733     | 45             | D            | 24      | 002130     | 56             | C-           | 14      |
| 600292     | 33             | E            | 34      | 002149     | 45             | D            | 24      | 002756     | 58             | C-           | 12      |
| 000069     | 35             | E            | 33      | 600416     | 46             | D            | 23      | 601369     | 58             | C-           | 12      |
| 300092     | 36             | E            | 32      | 300449     | 47             | D            | 22      | 601991     | 59             | C-           | 11      |
| 002318     | 37             | E            | 31      | 603308     | 48             | D            | 21      | 603699     | 60             | C           | 10      |
| 601958     | 37             | E            | 31      | 600169     | 50             | C-           | 20      | 002266     | 61             | C           | 9       |
| 601179     | 38             | E            | 30      | 002564     | 50             | C-           | 20      | 600516     | 61             | C           | 9       |
| 002144     | 38             | E            | 30      | 600973     | 51             | C-           | 19      | 002555     | 61             | C           | 9       |
| 600562     | 39             | E            | 29      | 002011     | 51             | C-           | 19      | 000381     | 64             | C           | 8       |

5. Conclusions and recommendations

5.1. Conclusion

According to Table 9, it can be seen that HSE perspective makes the overall performance of nuclear power companies generally worse and most of them have performed at or below medium level. Moreover, 12% of the companies perform well, 45% of the companies perform moderately, 16% of the companies perform poorly, and 27% of the companies perform worst. China Nuclear Power’s overall performance is best and scored 80 points totally, which is consistent with its leader status. The worst performer with negative total score was Qun Xing Toys, which may be related to the recent nuclear power business.
Table 10. Scores and rankings of Chinese nuclear power companies based on HSE perspective.

| Stock code | Financial performance | Ranking | Score | Stock code | Innovation performance | Ranking | Score | Stock code | HSE performance | Ranking | Score | Stock code | Comprehensive performance |
|------------|-----------------------|---------|-------|------------|------------------------|---------|-------|------------|-----------------|---------|-------|------------|----------------------------|
| 600835     | 60.019                | 1       | 601958| 10.019     | 600835                 | 1       | 6.972 | 601958     | 80              | 1       | 6.972 | 601958     | 1                          |
| 600328     | 59.773                | 2       | 603308| 6.173      | 600835                 | 2       | 6.899 | 600328     | 78              | 2       | 6.899 | 600328     | 2                          |
| 601985     | 57.730                | 3       | 000967| 5.476      | 601985                 | 3       | 6.828 | 000967     | 77              | 3       | 6.828 | 000967     | 3                          |
| 002366     | 56.586                | 4       | 002227| 5.024      | 601985                 | 4       | 6.821 | 002366     | 74              | 4       | 6.821 | 002366     | 4                          |
| 600110     | 55.501                | 5       | 600416| 4.732      | 600900                 | 5       | 6.793 | 600110     | 73              | 5       | 6.793 | 600110     | 5                          |
| 000811     | 54.283                | 6       | 000733| 3.967      | 000027                 | 6       | 6.687 | 000811     | 72              | 6       | 6.687 | 000811     | 6                          |
| 600021     | 51.758                | 7       | 300092| 3.825      | 601991                 | 7       | 6.685 | 600021     | 65              | 7       | 6.685 | 600021     | 7                          |
| 60900      | 51.025                | 8       | 002184| 3.823      | 600021                 | 8       | 6.6   | 002145, 6000601, 600889, 601727, 000981 | 64         | 8       | 6.6   | 002145, 6000601, 600889, 601727, 000981 | 64         |
| 002145     | 50.855                | 9       | 601369| 3.788      | 300092                 | 9       | 6.580 | 602255, 600516, 002266 | 61         | 9       | 6.580 | 602255, 600516, 002266 | 61         |
| 000601     | 49.918                | 10      | 002057| 3.694      | 002227                 | 10      | 6.4   | 603699     | 60              | 10      | 6.4   | 603699     | 10                         |

Figure 2. China's nuclear power listed companies' scores based on the HSE perspective.

According to Table 10 and Figure 2, there are 14 companies with comprehensive scores in the top ten. Furthermore, 6 of them were listed before 2000, accounting for 42.9%, and the remaining 8 companies were listed after 2000, accounting for 57.1%. This indicates that China's nuclear power industry is developing, and the influence of established nuclear power companies is weakening. Some emerging nuclear power companies are expected to be the main driving force in the future. Therefore, China can accelerate energy structure transformation by supporting emerging nuclear power companies. However, the huge contribution of established nuclear power companies cannot be ignored. The government must make the most of their rich experience to guide them to innovate actively, and encourage them to communicate with emerging companies in technology.

Comparing the financial score with the comprehensive score, most of the top ten companies in
finance overlap with the top ten companies in comprehensive performance, which indicates that financial performance has a greater impact on the comprehensive performance. However, there are some top ten companies that are not in the top ten financial rankings, such as China Nuclear Construction, China Guangdong Nuclear Technology, Hai Lu Heavy Industry, Fang Da Carbon, Zhe Fu Holdings, Neway, TBEA, and Shanghai Electric. In fact, except for CGNPC, the financial rankings of the remaining companies are within 20, which again illustrates the importance of financial performance. Also, it provides an improvement method for nuclear power companies with poor financial performance to improve comprehensive strength by focusing on innovation and HSE performance.

Comparing innovation score with comprehensive score, the top ten companies did not overlap. Does this mean these companies have weak innovation abilities? Taking some early listed nuclear power companies as examples, such as Shanghai Mechanical and Electrical, Norder, Shaoneng, and China Guangdong Nuclear Technology. Their innovation performance is not optimistic, but it doesn’t prevent them from gaining corresponding experience. So, the temporary lack of innovation performance will not limit the long-term development of enterprises. It should be noted that the data selected here is only for 2018. It’s not reasonable to completely link short-term innovation performance with comprehensive performance. Some companies can also get strong market competitiveness by increasing their investment in research and development.

Comparing the HSE score with the comprehensive score, the companies ranked only partially overlapping, namely CGN Nuclear Technology, China Nuclear Construction, China Nuclear Power, Yangtze Power and Shanghai Power. Except for CGNPC, the other companies were listed after 2000. It shows that China's nuclear power industry has vigorous development trend, which is related to positive policies of nuclear power issued by the government. In addition, above companies all have detailed and independent social responsibility reports, which are used to disclose corporate social responsibility performance. Some companies are even completely unaffected by the lack of reports to disclose relevant information. Therefore, HSE performance plays a supporting role in the comprehensive performance of listed nuclear power companies and points the way for the high-quality development of the nuclear power industry.

5.2. Recommendations
For the government, the key to implementing the safe development of nuclear power is to improve nuclear power related policies, especially the disclosure of HSE information in annual reports. For energy companies, they must take into account social and environmental benefits when developing, especially HSE performance. At the same time, all energy companies should actively disclose social responsibility in related reports, especially HSE information. In addition, companies need to strengthen R&D capabilities and turn them into their core competitiveness.

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