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RESEARCH ARTICLE

Comparative financial analysis of public and private sector firms in the Indian seed industry

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Abstract

One of the fastest developing industries in India is the seed sector. The sector aids in the advancement of agriculture in the country, which is vital with regard to increasing productivity at the farm level and food security. The Indian seed market is expected to reach USD 3.82 billion by 2025 and increase by a further USD 5.01 billion by 2030, exhibiting a CAGR (Compound Annual Growth Rate) of 5.56% during this period. These trends indicate that seed companies are making significant investments in R&D to produce new and modernized varieties that exhibit desirable features such as disease and drought tolerance. The Indian seed companies' financial performance is not consistent, as it depends on their market share, degree of innovation and efficiency in operations. This research intends to examine the financial performance of the Indian seed industry, highlighting public and private sector seed firms in India between 2015 and 2023. This study concludes that financial stability is a must for the better performance of seed sector in India. However, seed sector in India is financially helpless, the private sector companies perform better when compared with public sector companies.

Keywords: Altman z-score; bankruptcy; performance analysis; seed industry

Introduction

The Indian seed industry is one of the most vibrant in the nation, with an active intervention of both the private and public sectors. Availability of quality seed was instrumental in propelling the Green Revolution, considerably increasing grain yields and aggregate farm productivity. The creation of the National Seeds Corporation in 1963 was the starting point of an organized seed industry in India (1). India's seed industry was dominated by the public sector. But with the coming into force of the New Policy on Seed Development (NPSD) in 1988, a paradigm shift took place, enabling both local and global seed firms to import seeds and technologies and to invest in R&D. India is becoming the world's biggest seed market (2). Improved high-quality seeds with high yields, among other important agricultural inputs, have been key in revolutionizing the agriculture sector. Ensuring that farmers have access to quality seeds is essential in increasing agricultural production and productivity. Seeds alone are said to contribute 20-25% towards total productivity (3). India possesses two types of seed systems: formal and informal. The formal seed system entails a formal process that yields well-defined seed products. It generally encompasses public research organizations, public and private sector organizations engaged in seed production and marketing, as well as institutions responsible for seed certification and quality assurance (4). Seed technology acts as the link between the generation of improved varieties and their actual benefits reaching farmers. It incorporates the scientific process of seed multiplication, processing and storage, but in a way that guarantees the quality of seeds to remain high (5). Technological and scientific progress is at the center of seed businesses, which allows them to adapt to changing agricultural needs and contribute to world food security. With techniques such as advanced breeding, genetic engineering and genome sequencing, they try to develop seeds with improved traits like increased yields, tolerance to pests and diseases, ability to cope with environmental stresses and improved nutritional quality (6).

Financial performance analysis is the process of evaluating a company's financial health, stability and profitability using various tools and metrics. Measurement of financial performance includes various ratios like Net profit ratio, Gross profit ratio, Operating ratio, Return on shareholder funds ratio, Return on total asset ratio, Return on inventory ratio (7). Seed companies adopted certain effective strategies related to product quality, pricing, production and seed distribution, which resulted in modest growth in sales and revenue (8).

The Altman Z-Score model is a useful analytical model for the assessment of the financial health and performance of firms in an industry (9). Altman Z-score is used in performance analysis to understand the seed industry. It is also used to predict bankruptcy in companies. Initially, it was used especially in banking sector and now, it is used as a performance analysis tool. The model includes five basic financial ratios, viz., liquidity, profitability, leverage, solvency and activity ratios. Altman model

provides 72-80% reliability in performance analysis compared to other financial analyses (10). This research uses the Z-Score model not only to detect possible financial distress but also to contrast the financial performance of public and private seed firms. In doing so, it will provide more detailed insights into the economic sustainability and risk profile of the industry and help improve our understanding of its role and sustainability in the larger agricultural economy.

Objectives of the study

1. To identify the financial health and stability of the Indian seed industry
2. To compare the financial performance of private and public sector seed companies operating in India.

Limitations of the study

1. The study is confined to only selected seed companies based on the limited availability of data
2. The present study covers only a period of nine years.
3. The study relies on secondary data.

Materials and Methods

Sample selection

The research focused on the financial performance of 44 firms, which included 5 public sector undertakings and 39 private listed and unlisted companies in India's seed industry. The financial data and the market prominence of these companies were important metric with regard to selecting the firms for the analysis. This analysis was from the year 2015 to 2023, a total of nine years.

For this assessment, quantitative data is collected from firm annual reports in the CMIE (Centre for Monitoring Indian Economy) Prowess database, which is a comprehensive and authoritative resource on the financial performance of Indian companies. The main financial evaluation tool used for the firms was the Altman Z-score model, which predicts corporate bankruptcy in highly leveraged companies. This model provided a clear analysis of the financial solvency of the corporations, which supported understanding in regard to the performance of various forms of ownership and market segmentation within the Indian seed industry

Application of Altman Z Score model

The Altman Z-Score model, developed by American economist Edward I. Altman in 1968, is a widely respected tool for assessing the financial health and stability of a business. Originally designed to predict the likelihood of a company facing financial distress or bankruptcy within a short time frame-typically within two years-it has stood the test of time. Over the years, the model has been refined and is now considered one of the most reliable indicators of a company's financial well-being, with an accuracy rate ranging between 72% and 80%.

For private companies, especially those that aren't listed on stock exchanges, a modified version of the Z-Score is often used. Instead of relying on market-based figures like the market value of equity, this variation uses accounting-based data, which is more suitable and practical for evaluating unlisted firms.

In this study, the following version of the Altman Z-Score formula was used:

$$Z = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E$$

Where, A = Working Capital / Total Assets, B = Retained Earnings / Total Assets, C = EBIT / Total Assets, D = Book Value of Equity / Total Liabilities, E = Net Sales / Total Assets

Each component of the formula offers insights into a different aspect of a firm's financial performance:

A = Working capital / Total assets

This ratio measures liquidity, showing how much of the company's total assets are financed through working capital. Working capital-calculated as current assets minus current liabilities-is a crucial indicator of a firm's ability to meet its short-term obligations. A positive value reflects healthy cash flow and efficient operations, while a negative value might signal trouble in covering short-term debts. In the seed industry, where cash flows can fluctuate with the agricultural seasons, effective working capital management is vital for smooth operations.

B = Retained earnings / Total assets

This metric shows how much of the company's assets are financed through retained earnings rather than external funding. A high ratio suggests the company has a strong history of profitability and reinvestment, reducing reliance on debt. In contrast, a low or negative ratio could indicate past losses or a tendency to pay out profits as dividends rather than reinvest them. For seed companies, which often require reinvestment in research, infrastructure and innovation, a healthy level of retained earnings supports long-term growth and market competitiveness.

C = EBIT / Total assets

This ratio measures how effectively a firm is using its assets to generate operating income (earnings before interest and taxes). A higher value means the company is efficiently turning its resources into profits, while a lower or negative value suggests underutilized assets or operational inefficiencies. In the seed industry-where costs related to research, development and production are high-this ratio is a key indicator of core business performance.

D = Book Value of Equity / Total liabilities

For private firms without publicly traded shares, the book value of equity (which includes share capital and reserves minus accumulated losses) is used in place of market value. This ratio helps assess the company's solvency by showing how much of its liabilities can be covered by equity. A high value indicates financial strength and low dependence on borrowed funds, while a low or negative value points to higher financial risk. Given the capital-intensive nature of seed businesses, maintaining a solid equity base is essential for weathering economic or operational challenges.

E = Net Sales / Total assets

This final component evaluates how efficiently a company is using its assets to generate revenue. A higher ratio reflects better asset utilization and effective operations. However, a low ratio could suggest underperformance or inefficient use of resources. In the seed industry-where key assets include production units, technology and inventories-this measure

helps assess how well these resources are being converted into real sales and business outcomes.

Why Altman Z-Score model?

Altman Z-score model brings together several financial ratios into one comprehensive score, offering a numerical assessment of a company's likelihood of facing bankruptcy. Beyond just predicting financial distress, the model holds broader value due to its straightforward structure, flexibility in application and reliability. These qualities have led to its widespread use in financial evaluations across various sectors and countries (11). The interpretation of the Z-score is illustrated in Table 1 (12).

Research flow diagram for analysing the financial viability of Indian seed companies is given in Fig. 1

Table 1. Z-Score interpretation (12)

Z-Score	Zone	Interpretation
Above 2.99	Safe Zone	Strong financial health; bankruptcy unlikely
1.8 to 2.99	Grey Zone	Uncertain financial position; risk cannot be ruled out
Below 1.8	Distress Zone	Financially unstable; high risk of bankruptcy

Results

Financial performance of companies is analysed through Altman model. The proportion of working capital to total assets reflects the liquidity position of the company. Retained earnings to total assets ratio reveals the extent to which total assets have been financed through retained profits. The ratio of earnings before interest and tax to total assets reflects how

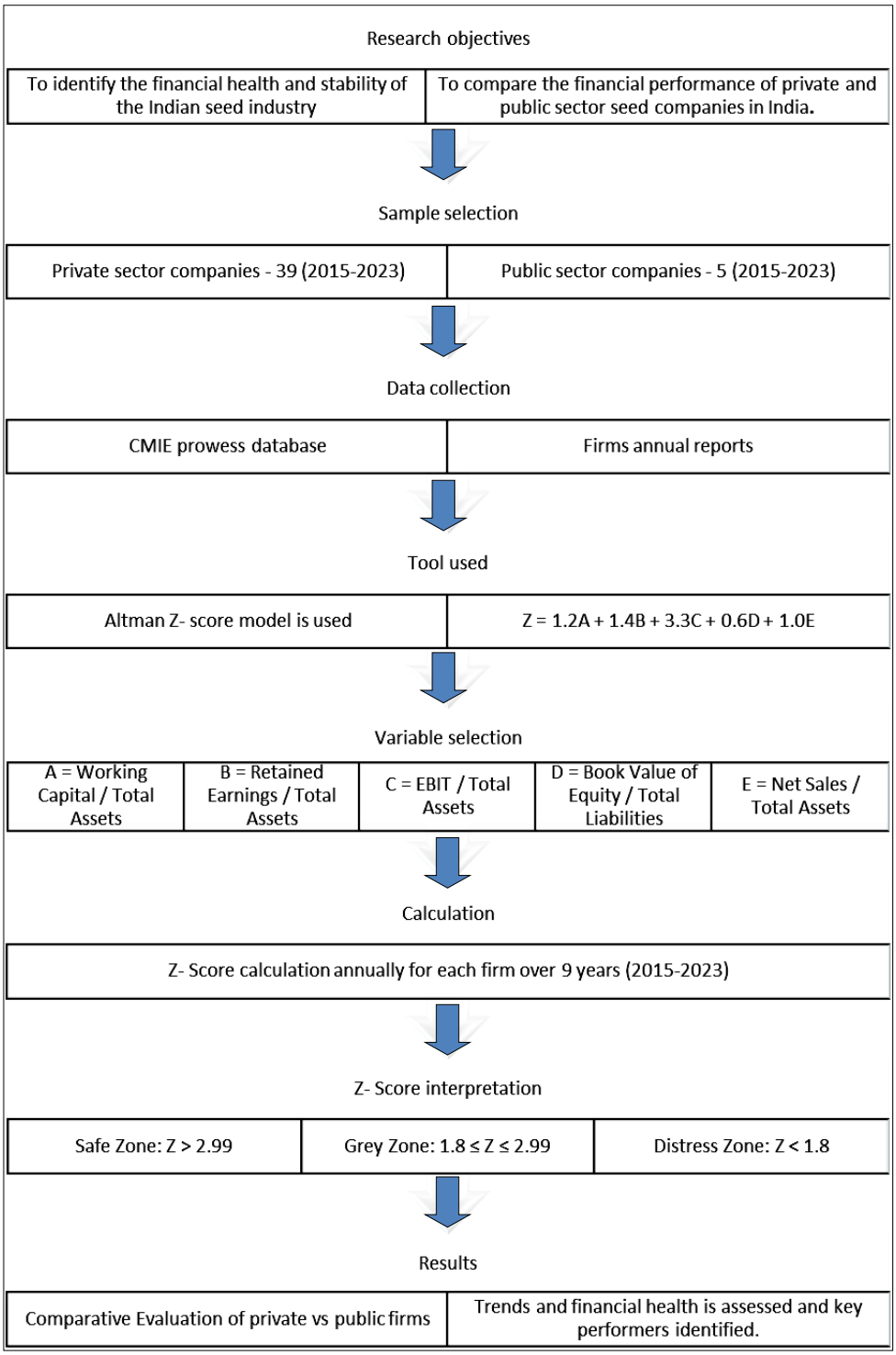

Fig. 1. Research flow diagram

efficiently a company's assets are used to generate operating income. The ratio of market value of equity to book value of liabilities helps evaluate the strength and stability of a company's long-term financial strategies. The sales to total assets ratio indicates how effectively a company utilizes its assets to generate revenue (12).

The Altman Z-score test conducted for 39 private and public sector seed companies for nine years (2015-2023) projects a mixed picture of their financial performance. The details of the companies are available in Table 2. There are some firms that demonstrate steady financial health, a significant majority of them are in a zone of uncertainty (Grey) and a few are indicating serious financial trouble. The average Z-score for the industry is 2.54, which is in the Grey Zone. This indicates the sector, overall, is not financially sound and most firms are in a risky or unstable position. Even though this doesn't imply that bankruptcy is inevitable, it does mean that firms will have to do things to improve their financial strength. The findings of the z score test of the Seed industry on the basis of ownership pattern are presented in Table 3.

Based on risk zone

Safe zone

Taking the company-wise performances, there are hardly any companies like A3 (Bayer Bioscience Pvt. Ltd..), A4 (Bombay Super Hybrid Seeds Pvt. Ltd..), A6 (Continental Seeds & Chemicals Pvt. Ltd..), A8 (Eagle Seeds & Biotech Pvt. Ltd..), A21 (Mangalam Seeds Pvt. Ltd..), A23 (Nath Bio-Genes (India) Pvt. Ltd..), A33 (Seeds & Grains India Pvt. Ltd..) and A35 (Syngenta India Pvt. Ltd..) that have continued to score over 3.0, finding themselves in the Safe Zone. These companies are doing well financially and have a low risk of failure.

Distress zone

Some companies, however, such as A12 (Green Gold Seeds Pvt. Ltd..), A26 (Omega Ag-Seeds (Punjab) Pvt. Ltd..), A31 (Ruchi Hi-Rich Seeds Pvt. Ltd..), A32 (Savannah Seeds Pvt. Ltd..) and A39 (Winseed Agri Pvt. Ltd..) have below-average scores of less than 1.8, placing them in the Distress Zone. These companies have a higher chance of experiencing financial issues if it does not take immediate corrective measures. They must prioritize profitability, liquidity and asset management.

Grey zone

Most of the companies, however, fall under the Grey Zone. A1 (Ajeet Seeds Pvt. Ltd..), A2 (Avani Seeds Pvt. Ltd..) and A5 (Charoen Pokphand Seeds (India) Pvt. Ltd..), A7 (Corteva Agriscience Seeds Pvt. Ltd..), A9 (East West Seeds India Pvt. Ltd..), A10 (Ganga Kaveri Seeds Pvt. Ltd.), A11 (Godrej Seeds & Genetics Pvt. Ltd..), A13 (Harman Cottex & Seeds Pvt. Ltd.), A14 (K K Seed Pvt. Ltd..), A15 (Kalash Seeds Pvt. Ltd.), A16 (Kaveri Seed Co. Pvt. Ltd..), A17 (Kirti Seeds Bio Tech Pvt. Ltd..), A18 (Lord Pashupati Seeds Pvt. Ltd.), A19 (Maharashtra Hybrid Seeds Co. Pvt. Ltd.), A20 (Malav Seeds Pvt. Ltd.), A22 (Mudra Seed Sciences Pvt. Ltd.), A24 (Nunhems India Pvt. Ltd.), A25 (Nuziveedu Seeds Pvt. Ltd..), A27 (Pan Seeds Pvt. Ltd.), A28 (Pandey Seeds Pvt. Ltd.), A29 (Rasi Seeds Pvt. Ltd.), A30 (Ravi Seeds Research Pvt. Ltd.), A34 (Seedworks International Pvt. Ltd..), A36 (Tokita Seed India Pvt. Ltd.), A37 (V N R Seeds Pvt. Ltd.), A38 (Vishwas Agri Seeds Pvt. Ltd..), B1 (Andhra Pradesh State Seeds Devp. Corpn. Ltd.), B2 (Maharashtra State Seeds

Table 2. Seed companies selected for study

S.No.	Name of the Company	Identifier
1	Ajeet Seeds Pvt. Ltd.	A1
2	Avani Seeds Ltd.	A2
3	Bayer Bioscience Pvt. Ltd.	A3
4	Bombay Super Hybrid Seeds Pvt. Ltd..	A4
5	Charoen Pokphand Seeds (India) Pvt. Ltd.	A5
6	Continental Seeds & Chemicals Pvt. Ltd..	A6
7	Corteva Agriscience Seeds Pvt. Ltd.	A7
8	Eagle Seeds & Biotech Pvt. Ltd..	A8
9	East West Seeds India Pvt. Ltd.	A9
10	Ganga Kaveri Seeds Pvt. Ltd.	A10
11	Godrej Seeds & Genetics Pvt. Ltd..	A11
12	Green Gold Seeds Pvt. Ltd.	A12
13	Harman Cottex & Seeds Pvt. Ltd.	A13
14	K K Seed Pvt. Ltd..	A14
15	Kalash Seeds Pvt. Ltd.	A15
16	Kaveri Seed Co. Pvt. Ltd.	A16
17	Kirti Seeds Bio Tech Pvt. Ltd.	A17
18	Lord Pashupati Seeds Pvt. Ltd.	A18
19	Maharashtra Hybrid Seeds Co. Pvt. Ltd.	A19
20	Malav Seeds Pvt. Ltd.	A20
21	Mangalam Seeds Pvt. Ltd..	A21
22	Mudra Seed Sciences Pvt. Ltd.	A22
23	Nath Bio-Genes (India) Pvt. Ltd..	A23
24	Nunhems India Pvt. Ltd.	A24
25	Nuziveedu Seeds Pvt. Ltd..	A25
26	Omega Ag-Seeds (Punjab) Pvt. Ltd..	A26
27	Pan Seeds Pvt. Ltd.	A27
28	Pandey Seeds Pvt. Ltd.	A28
29	Rasi Seeds Pvt. Ltd.	A29
30	Ravi Seeds Research Pvt. Ltd.	A30
31	Ruchi Hi-Rich Seeds Pvt. Ltd.	A31
32	Savannah Seeds Pvt. Ltd.	A32
33	Seeds & Grains India Pvt. Ltd.	A33
34	Seedworks International Pvt. Ltd..	A34
35	Syngenta India Pvt. Ltd.	A35
36	Tokita Seed India Pvt. Ltd.	A36
37	V N R Seeds Pvt. Ltd.	A37
38	Vishwas Agri Seeds Pvt. Ltd..	A38
39	Winseed Agri Pvt. Ltd.	A39
40	Andhra Pradesh State Seeds Devp. Corpn. Ltd..	B1
41	Maharashtra State Seeds Corpn. Ltd..	B2
42	National Seeds Corpn. Ltd..	B3
43	Rajasthan State Seeds Corpn. Ltd.	B4
44	Gujarat State Seeds Corpn. Ltd.	B5

Table 3. Estimated Altman Z-score for sample seed companies (2015-23)

Companies/ years	2015	2016	2017	2018	2019	2020	2021	2022	2023	AVG	Interpretation
Z Score for Private Sector Companies											
A1	3.55	1.70	0.74	1.78	1.88	3.42	3.51	3.67	3.72	2.66	Grey
A2	2.70	2.69	2.84	2.31	3.73	2.13	2.28	2.42	2.57	2.63	Grey
A3	2.28	3.01	2.65	2.44	2.89	3.97	3.12	3.25	3.39	3.00	Safe
A4	3.59	2.70	3.02	2.12	2.75	3.43	3.02	3.18	3.31	3.01	Safe
A5	3.48	1.37	2.32	2.39	1.13	2.89	3.27	3.43	3.52	2.64	Grey
A6	3.91	3.43	3.77	3.68	5.33	2.28	2.31	2.45	2.59	3.31	Safe
A7	1.57	3.75	4.33	3.89	3.97	2.06	2.11	2.29	2.42	2.93	Grey
A8	2.05	2.66	3.60	3.30	3.65	2.76	2.91	2.97	3.05	2.99	Safe
A9	1.65	2.83	3.18	2.89	2.69	2.71	3.08	3.13	3.25	2.82	Grey
A10	3.39	1.11	1.35	1.24	1.98	3.01	2.97	3.06	3.19	2.37	Grey
A11	1.68	0.78	1.73	3.55	4.23	2.52	2.39	2.45	2.59	2.44	Grey
A12	1.94	0.46	0.23	(0.11)	0.97	2.26	2.14	2.31	2.47	1.41	Distress
A13	1.25	3.46	3.16	3.59	4.53	2.49	2.58	2.76	2.91	2.97	Grey
A14	1.85	1.80	2.17	2.70	2.89	1.89	1.83	1.88	1.98	2.11	Grey
A15	2.70	2.38	2.15	3.34	2.32	2.59	2.86	2.97	3.08	2.71	Grey
A16	3.09	3.20	2.87	2.51	1.75	3.16	3.26	3.39	3.57	2.98	Grey
A17	4.76	4.04	3.78	2.87	3.46	1.75	1.77	1.84	1.04	2.81	Grey
A18	3.22	1.87	2.32	2.14	3.01	1.92	1.83	1.89	1.97	2.24	Grey
A19	3.63	2.65	2.99	2.72	3.40	2.12	1.89	2.01	2.13	2.62	Grey
A20	3.03	3.20	2.60	2.61	2.66	2.38	2.21	2.35	2.46	2.61	Grey
A21	3.77	2.84	3.57	3.25	3.60	2.82	2.99	3.14	3.28	3.25	Safe
A22	3.65	1.96	1.74	2.46	1.80	1.97	1.91	2.03	2.15	2.19	Grey
A23	3.59	2.67	3.19	3.02	3.55	2.58	2.63	2.79	2.87	2.99	Safe
A24	4.50	2.79	3.04	2.52	2.94	2.66	2.58	2.71	2.85	2.95	Grey
A25	(0.15)	3.39	3.01	1.44	3.39	3.22	3.34	3.46	3.58	2.74	Grey
A26	2.51	1.42	1.25	1.20	(0.28)	1.83	1.77	1.83	1.91	1.49	Distress
A27	3.02	2.68	2.82	2.52	2.71	2.38	2.52	2.69	2.83	2.69	Grey
A28	1.70	1.78	1.75	1.91	2.90	1.87	1.76	1.82	2.08	1.95	Grey
A29	2.90	1.68	1.92	1.84	2.28	2.71	2.85	3.01	3.14	2.48	Grey
A30	2.14	2.46	2.22	2.35	2.34	2.35	2.42	2.63	2.77	2.41	Grey
A31	1.80	0.65	0.77	1.36	1.40	2.05	1.97	2.11	2.23	1.59	Distress
A32	2.08	0.78	0.78	0.86	0.55	2.01	2.08	2.24	2.39	1.53	Distress
A33	3.61	3.87	3.21	4.67	5.13	2.32	2.38	2.51	2.64	3.37	Safe
A34	4.39	1.08	1.02	0.80	1.39	2.52	2.57	2.69	2.83	2.14	Grey
A35	2.44	3.98	3.71	5.11	4.71	2.78	3.09	3.25	3.39	3.61	Safe
A36	2.95	1.93	1.81	2.29	2.17	2.30	2.49	2.64	2.79	2.37	Grey
A37	1.44	2.95	2.79	2.90	2.83	2.62	2.77	2.89	2.72	2.66	Grey
A38	3.23	2.16	2.46	3.06	2.31	2.09	2.23	2.45	2.61	2.51	Grey
A39	2.12	1.30	1.19	0.92	0.66	1.72	1.68	1.75	1.88	1.47	Distress
Average										**2.56**	Grey
Z Score for public sector companies											
B1	2.15	2.68	2.06	1.31	1.56	2.35	2.63	2.76	2.83	2.26	Grey
B2	3.86	2.80	2.47	1.84	2.07	2.76	2.58	2.67	2.81	2.65	Grey
B3	2.21	3.02	2.93	1.35	2.18	2.45	2.41	2.58	2.71	2.43	Grey
B4	2.18	1.72	1.82	1.35	1.64	2.44	2.53	2.62	2.78	2.12	Grey
B5	2.36	1.54	1.54	0.29	1.67	2.88	2.74	2.83	2.95	2.09	Grey
Average										**2.36**	Grey
Overall Industry Average										**2.54**	Grey

Corpn. Ltd.), B3 (National Seeds Corpn. Ltd.), B4 (Rajasthan State Seeds Corpn. Ltd.) and B5 (Gujarat State Seeds Corpn. Ltd.) belong to this category. Such firms fall in the moderate risk group, where their future financial health is unsure and may go either way based on how efficiently they conduct their operations.

Based on ownership pattern

Private firms have an average Z-score of 2.56, whereas public sector firms average 2.36. Both belong to the Grey Zone, though private firms are just that little bit better placed. This could be the result of more flexible management, improved resource utilization, or faster decision-making. As time passed, most firms improved their financial scores, particularly in the second half of the study period. There are, however, some firms whose scores varied significantly, which could be the result of changing market conditions, internal problems, or external shocks.

Conclusion

The Indian seed business is said to be financially vulnerable according to the findings of the study, with majority of the companies operating in the grey or distress areas according to the Altman Z-score formula. The research also indicates that private sector companies performed better financially compared to public sector companies during the study period. The research revealed that companies with longer business years and stable management practices had a tendency to outperform others on a regular basis in financial health. On the other hand, several companies recorded poor financial performance and are at risk unless prompt remedial measures are taken. In the coming years, the Indian seed market is expected to see huge growth as the demand for quality seeds keeps on rising, awareness of hybrid and biotech seeds keeps on increasing and the positive government policies persist. Moreover, there is increased focus on climate-resilient and sustainable agriculture that is promoting the use of higher-quality seed varieties. This evolving world provides new prospects for investment, development and innovation in the sector. To utilize these opportunities and compete in the future, however, companies must ensure they have stable financial bases.

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Authors' contributions

NTP contributed to article collection, analysis, interpretation and formulated the manuscript. KM contributed by developing ideas and reviewing the manuscript. SML helped in summarizing the manuscript.

Compliance with ethical standards

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