Multi-Dimensional Financial Performance Ranking and Inter-Rank Agreement Analysis Using Kendall's Coefficient of Concordance (W): Evidence from Selected Cement Companies

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HOW TO CITE:

Manjur Alam, Rabin Mazumder (2026). Multi-Dimensional Financial Performance Ranking and Inter-Rank Agreement Analysis Using Kendall's Coefficient of Concordance (W): Evidence from Selected Cement Companies.

International Journal of Special Education, 41(10s), 1121-1134

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ABSTRACT:

We require a multi-dimensional framework for Corporate Financial Performance that provides breadth and incorporates perspectives extracted from the multiple dimensions of operational, balance sheet strength for measuring capital gains: corporates. This ranking integrates profitability, liquidity and operational efficiency to provide an overview of the financial strength of selected cement companies. A final rank is assigned to each of those dimensions and a cumulative performance score comes through a summative ranking approach. Rankings within each industry are from high to low based on a composite performance that provides an overall view of financial health.

In other words, Kendall's Coefficient of Concordance (W) is employed as a non-parametric measure of agreement among rankings to determine if these financial dimensions are complementary in analyzing companies. A value of W = 0.415 would suggest some moderate correlation among the 3 ranking criterions used overall. They were however statistically insignificant at the conventional level as measured by their associated chi-square statistic (17.43) in assuming non-agreement/concurrence to be meaningfully commonplace between measures of profitability, liquidity and efficiency.

The result also underscores the inherently multi-faceted nature of financial performance in capital-intensive areas such as cement. Weak concordance implies that companies who excel on one dimension do not necessarily also excel in other dimensions. The composite valuation model can be used by investors, managers and researchers to use a robust and composite measure of corporate financial health.

Keywords: Financial Performance; Composite Ranking; Profitability; Liquidity; Operational Efficiency; Kendall's Coefficient of Concordance; Cement Industry.

Introduction

Assessing financial performance is at the core of corporate finance, accounting research and strategic management because it provides insight into a company's historical ability to maintain solvency, returns and persist in an competitive economic environment. In contrast to capital- and competitive-intensive industries, however, performance assessment is not an academic topic, even in the small number of instances where it seriously informs investment decisions, credit evaluation, management remuneration and strategic planning. Let's go some decades back and talk about the way Financial Analyze used to happen in those days, it was largely based on single ratios which was taken in isolation e.g. Return on Assets, Current rations or Asset turnover ratio. And while all are good indicators, they should be viewed holistically and individually, as each evaluated in isolation can lead to bad conclusions.

Performance has been the holy grail of financial research since before its birth, through the modern-day corporate finance as it functions — and that field increasingly knows that corporate performance is multidimensional. Profitability on the other hand means, mere survival and producing shareholder value. Liquidity ratios — a group of measures that show the shoet-term ability of the firm to satisfy its obligations and manage working capital. Whereas efficient metrics give one an impulse on how expenses work concerning income. These three dimensions are interconnected yet structurally separate. For instance, expanding policies can lead to an increase in efficiency and profit margins often at the expense of liquidity. In contrast, conservative liquidity management methods can lower risk, but also restrict returns. For this reason, analyzing businesses through the lens of one view is not enough to reflect aggregate fiscal health.

This paper highlights one of such multidimensional financial evaluation with special emphasis on cement industries. Its production needs is of significant capital and energy, in addition to macroeconomic sensitivity. Published Prices Are Most Often Shaped by Local Competition and Capacity Utilization Rates While The firms require the margins from operational efficiency to keep a lid on costs, liquidity when cyclicality is working against you and in the end typically need to profit after growing prices enough at the back end to justify large capital investments. The structural properties create heterogeneity in several dimensions of performance across firms, making composite analysis important and substantive.

This intention leads towards current research focuses a composite ranking structure for building a complete performance score (in the form of ultimate profitability rank [UPR], ultimate liquidity rank [ULR] and ultimate efficiency rank [UER]). On an industry-wide scale, the summative ranking type structure enables firms to be assessed alongside one another. But aggregation does not in itself say anything at all about revenue-neutral dimensions underlying the numbers and meaningfully existing relative to stable forms of significance. This issue in methodology has been solved using Kendall's Coefficient of Concordance (W), a non-parametric statistical measure that assesses the degree of agreement among raters, in this case to what extent rankings based on profitability, liquidity and efficiency agree.

Using composite performance ranking and statistical concordance test, this study adds to the literature on financial performance in three ways. It provides, first, a holistic evaluative framework that can be applied across capital-intensive sectors. Second, it explores whether alternative balancing dimensions converge in evaluating firms from a statistical perspective. This part of the research is highly focused on the empirical investigation of structural independence/interdependence of cement sector financial indicators. Overall, the findings are expected to assist investors, financial analysts, corporate managers and academic researchers in understanding real challenges involved in measuring over all performance on project investment and need for a multi-dimensional analytical framework.

Literature Review

Ratio analysis has been extrapolated often as the key driver of financial performance. The early view was by the ease with which accounting ratios enable to evaluate profitability and liquidity (Altman, 1968) and operational efficiency. Ratio based models took center stage as they provide inter-firm cross comparisons, graphical trend analysis associated with financial diagnostics. Nevertheless, later studies underscored the limitations of interpreting ratios in isolation when individual indicators can not reflect the multi-dimensionality of firm performance (Lev & Sunder, 1979).

As both the performance measurement frameworks matured, researchers started to call for a multi dimensional lens. In fact, this led to the generation of composite indices which at times would eclipse multi-measure metrics and overcome limitations, or problems with traditional measures (Kaplan & Norton, 1992). While the Balanced Scorecard framework was a brave step forward (and it did allow organizations to assess performance financially and beyond) it perpetuated the mental model that true performance must be separately measured on every axis.

The composite ranking and multiple criteria evaluation methods are widely used in finance to compare firms in the same industrial background. This allows the consolidation of performance ratios, such as profitability, liquidity and efficiency measures into a single score of performance (Feroz et al., 2003). Models for ranking or scoring multiple criteria, such as multi-criteria decision-making (MCDM) techniques, are also reducing interpretive bias and allowing more rigorous analysis.

There is increasing interest in the statistical validation of ranking systems as well. Kendall's W (the coefficients of concordance proposed by Kendall and Babington Smith, 1939) is a non-parametric statistic for measuring agreement among more than two rankings. The process was well studied in business and social sciences — under ordinal data/relative rankings. Siegel and Castellan (1988) further stated that it is most appropriately used with multiple evaluators or performance dimensions. A chi-square approximation allows inference of the statistical significance of the agreement based on the value of our test statistic.

Using capital expenditures of industrial sectors as the criterion to divide them into so-called capital-intensive industries, we find strong sectorial heterogeneity along with this and other performance characteristics. The difference between accounting profitability and accounting liquidity measures across firms reflects the heterogeneity of financial policy among firms, including their capital structure decisions but also their working capital management and asset utilization (Penman, 2013). And while you can get a one-size-fits-all model without big talking-data, such diversity explains the need of integrated evaluation frameworks: ones that are fitted above statistical testing.

However, there are still limitations within the literature despite such advances in methodology. Statistical concordance measures have helped to provide this insight in capital intensive environments; however, it is an under researched area fostering such analysis between ultimate profitability, liquidity and efficiency ranks. Current literature, however, has sufficient correlation analysis and profiling without much investigative work determining whether and how dimensions ranking converge in assessing firms. Wherein that is significant, and at times caused a blur, the absence of concordance testing regarding composite rankings can disguise structural misalignments among financial factors and result in investment and managerial (re)allocation blunders.

This paper also addresses this research gap by reaching a detailed composite ranking based on a statistical Kendall's W analysis in the cement industry that has high fixed costs, long turnover cycles and is highly sensitive to economic fluctuations. This research adds to the literature on financial performance by including both comparative elicitation and use of statistical validation that inform a richer understanding of

how high heterogeneity in firm performance arises through statistically validating the comorbidity between ranks that ultimately profitable, liquid firms would prefer over those less so.

Methodology

1.Research Design

In the current study, a qualitative comparative research design was employed for multi-faceted evaluation and contemporaneous enumeration of financial efficacy of the chosen cement manufacturing companies. Through compositional ranking and statistical conditioning of concordance, this raises the possibility of both comparative analyses alongside validation around agreement in dimensions. Analyzed is descriptive which indicates how performance indicators are perceived and whether its alignment among companies

2.Sample Selection

It is composed of fifteen major cement corporations among others. The selected companies were chosen by the availability of data, relevance to the industries and financial data comparability. Such reflects that the sample comprises relevant industry players, which conduces to sound inter-firm comparison.

3.Data Source and Period

This study used secondary data from published financial statements and verified financial databases of the refiners as well as companies. Three basic parameters of financial performance were computed with the data, which were aggregated as follows:

• Profitability indicators

• Liquidity indicators

• Efficiency indicators

All the indicators were aggregated to establish dimension-wise overall rankings.

4. Variables and Measurement

A clear evaluation framework based on financial performance across three broad dimensions was established:

4.1 Ultimate Profitability Rank (UPR)

Profitability is a measure of the earning ability of firms and their efficiency in generating returns on invested capital. Calculations of relevant profitability ratios were made and combined to create the final profitability rank for each company.

4.2 Ultimate Liquidity Rank (ULR)

Liquidity signifies the firm's short-term financial health and ability to fulfill short-term obligations. Each liquidity ratio was studied and merged to deliver liquidity ranks.

4.3 Ultimate Efficiency Rank (UER)

Efficiency measures how efficiently a firm employs its assets and operations to obtain revenue. Activity ratios were analysed and ranked.

Under the three dimensions, each firm has a rank. A lower numerical rank demonstrates better performance.

5. Composite Ranking Procedure

A summative ranking method was used to ascertain overall financial performance. Composite score was calculated as:

"Composite Score"=UPR+ULR+UER

The Ultimate Rank for each firm was then established in ascending order according to total scores. The lowest composite score indicated the best overall performer.

The rank summation method was chosen because (1):

It considers all performance dimensions equally.

It minimizes scale-related distortions.

It enables direct cross-firm comparison.

6. Statistical Tool for Agreement Analysis

Composite ranking tells us the relative positions of performances but does not say whether it happens that the three dimensions lead to consistent evaluation. Thus, Kendall's

Coefficient of Concordance (W) was utilized to assess inter-rank concordance between UPR, ULR and UER.

Kendall's W is computed as:

$$W = \frac{12S}{k^2(n^3 - n)}$$

Where:

- S= sum of squared deviations of rank totals from their mean
- k= number of ranking criteria (3)
- n= number of firms (15)

The value of W ranges from 0 to 1:

- 0 indicates no agreement
- 1 indicates perfect agreement

To test statistical significance, the Chi-square approximation was used:

$$\chi^2 = k(n-1)W$$

The computed chi-square value was compared with the critical value at the appropriate degrees of freedom $(n-1)$.

7. Hypothesis Development

The following hypotheses were developed to evaluate inter-dimensional agreement:

H_0 (Null Hypothesis): There is no significant consensus among the profitability, liquidity and efficiency rankings of selected cement companies.

Ho_1: No significant agreement exists regarding profitability, liquidity and efficiency rankings of selected cement companies.

The decision rule was to compare the calculated chi-square value with the critical value at the chosen level of significance.

Results and Discussion

1. Composite Financial Performance Ranking

Table 4D-I. Table 1 also shows the composite ranking of overall financial performance for those cement companies with respect to Ultimate Profitability Rank (UPR), Ultimate Liquidity Rank (ULR) and Ultimate Efficiency Rank (UER). The final rank is achieved by adding the three dimension-wise ranks, with a lower overall score indicating better financial performance.

The results show substantial heterogeneity across firms along various financial dimensions which adds support to our proposition that corporate financial strength is multi-dimensional in nature. Ambuja Cement ranked 1st on aggregate with a composite score of 12 The companies showed consistent performances across the three indicators, with very high efficiency (UER = 2) and profits and liquidity ranks better adjusted. This profile of operations will be sufficient to align management with financial sustainability.

Orient Cement was able to secure the 2nd position on one pager with a cumulative score of 13 premierly driven by sound efficiency performance (UER = 1) and strong liquidity (ULR = 2). Although moderately profitable (its profitability rank = 10), excellent operational efficiency gave a significant lift into its composite position. This implies that, once again, moderate profitability can be trumped by operational strength in a many-dimensional structure. Due to a tie, Shree Cement and JK Cement are ranked 3.5 (composite score = 13.5) But their conceptual frameworks for performance are very different. Shree Cement had IMD of one point five (UPR) with five points for uniformity (ULR = 5) since firm profited, yet in addition held satisfactory liquidity; JK cement showed low productivity and uncommon liquidity (ULR = 1); equal composite scores verifying structurally opposed arrangements perceive that organizations can achieve a similar overall efficiency through various authoritative courses.

Ultratech, with the best profitability rank (UPR = 1.5) and good efficiency (UER = 3), was pushed to position 5 because of relatively poor liquidity

performance (ULR = 11). What the latest data shows is that when liquidity is poor, being the most profitable player does not get you leading in the grand scheme of things.

Ramco Cement, ACC Cement and Heidelberg are other companies which got score moderately across dimensions in a detailed assessment that ranked them middle of the ranking. Conversely, Nuvoco ranked last (15th) with a composite score of 39 indicating relatively poor performance on all three dimensions. Using this same broad category classification, because of structural weaknesses in profitability and efficiency, India Cement and JK Lakshmi Cement came up towards the bottom end of India's cement players again.

Thus, the ranking pattern demonstrates that the composite evaluation prevents overemphasis of a single financial dimension and is conducive to have an overall industry performance assessment.

2. Inter-Dimensional Agreement Analysis

In order to test the consistency of firm ranking under profitability, liquidity and efficiency, Kendall's Coefficient of Concordance (W) was computed. The calculated value of:

W=0.415

It has mixed agreement across the three levels of ranking. This suggests that there is a certain degree of alignment but the dimensions are incomplete in their assessment of firms. Chi-square approximation was used to evaluate whether these differences were statistically significant:

$$\chi^2 = 17.43$$

The critical value (n − 1 = 14) is 23.685. Since value obtained is less than critical, we fail to reject null hypothesis of absence of agreement. So, the association between rank of profitability, liquidity and efficiency is statistically elusive.

3. Interpretation of Concordance Findings

This weak but statistically non-significant concordance has major ripple effects:

• Independence of Financial Dimensions

Firms do not move in lockstep on profit, liquidity and efficiency. The profitability of a strong company does not guarantee powerful liquidity or efficiency indicators.

• Strategic Trade-offs

Different cement sector financiers may choose to pursue differing strategies. Some methods could see firms pursuing aggressive expansion and greater efficiency, which may weaken liquidity positions. The other type may adopt conservative liquidity management practices that can affect profits.

• Capital-Intensive Industry Dynamics

Cement industry being highly fixed cost oriented, requires huge working capital and have cyclical nature of demand- this ensures structural wandering apart on most financial parameters. Such industry specifications make perfect concordance less likely.

• Validation of Multi-Dimensional Framework

There is valid statistical basis for composite ranking based on the low correlation of results rather than relying on any one measure of quality. If there were perfect agreement, then one dimension would suffice. However, differences in some variables highlight the importance of integrated assessment.

4. Discussion in Context of Financial Performance Theory

The findings are congruent with theoretical claims that the multidimensional structure is intrinsic to the financial performance. As misinformation is leveraged to affect market behavior in trading, according to agency theory and trade-off theory firms founded for should manage risk, return, and liquidity based on their strategic orientation as well as the responsive environment. Moderate value for concordance reflects this type of structural balancing behavior.

Furthermore, the results show how managerial practices differ in the cement industry. It is well established that companies can differ in their decisions on capital structure, cost control

mechanisms, working-capital management and operating strategies (Fama & French 1992), which lead to heterogeneous rank elements over the different dimensions. Such statistically insignificant consensus contributes evidence of the common justification for achieving corporate rating by a number-based approach rather than through ratios based mostly on profitability — as is traditional with classical stock performance analysis.

5. Summary of Key Findings

• Ambuja Cement was first overall performer due to optimum financial strength

• Improved efficiency contributed significantly to the improvement in overall rank for select companies (Orient cement, for example).

• Wielding of interest leadership alone did not guarantee all round supremacy (eg. Ultratech).

• Kendall's W (0.415) suggests moderate, but statistically non-significant agreement across dimensions.

• Within the cement industry, dimensions of financial performance function fairly independently.

(PCA-Based Composite Ranking – Table 4D-I.2)

1. Composite Financial Performance under Principal Component Analysis (PCA)

Table 4D-I. Table 2 shows the ranking of the selected cement companies after applying PCA to profitability, liquidity and efficiency indicators. In contrast with earlier naive total ranking approaches, PCA is a dimensionality reduction method that implicitly obtains statistical weights based on variance contribution to minimize multicollinearity for financial ratios while increasing the objectivity in the rank determination process.

As observed from the PCA-based composite ranking, movement in performance positions reflects a disparity resulting from statistical weighting under non-weighted framework to identify overall evaluation.

At the first position is Grasim Industries with composite score of 10 followed by sound performance across profitability (3.5), liquidity (3.5) and efficiency (3.0). The PCA framework indicates consistently good Grasim's financial performance is across statistically significant metrics. Ranked 2nd (composite score = 12) is Shree Cement, buoyed by strong ranks on profitability (2.0) and liquidity (2.0), despite a comparatively mediocre efficiency rank of 8.0. Hence PCA framework facilitates equity financial architecture at the expense of superior performance in a single locus.

Ultratech with an outstanding profitability (1.0) and efficiency (2.0), because of a very bad liquidity rank (15.0) at 3rd position A possible direction would be favour of PCA weighting mechanism which disadvantages impose a penalty with extreme divergence from any one dimension, also putting weight on financial solidity aspect Star Cement and The India Cements stood at 4th or 5th position respectively. In further contrast, India Cement's lesser PCA threshold places its results in a much better light when compared to the previous model despite no change to the underlying features being as comparatively similar (output score against competing measure(s).

JK Cement and ACC Cement were in mid-tier. The composite rank for JK Cement is 6 as it scores much lower-than-Average levels of efficiency (13.0) but higher than average liquidity (1.0). This once again illustrates how asymmetrical performance along arbitrary dimensions propagates to overall rank. On a similar note, Sagar Cement (15th) and Nuvoco (14th) expectedly showed weaker composite performance as Sagar Cement deserved the highest total rank score (41), which seemed to suggest poor performance relative to all PCA-derived dimensions.

Finally, the numerical PCA results indicate that not only are firms somewhat re-ordered relative to the equal-weight model but that stable statistical relationships between indicators may influence composite performance ranking concerning our bankers.

2. Inter-Dimensional Agreement under PCA Framework

To test consensus among the PCA based rankings of profitability, liquidity and efficiency, we computed Kendall's Coefficient of Concordance (W).

The calculated value:

$$W=0.437$$

suggests decent agreement over the three PCA-derived rank dimensions. This is somewhat higher than the simple ranking model (W = 0.415) and indicates that when using PCA weighting, the trees would be marginally better aligned.

The Chi-square approximation yielded:

$$\chi^2=18.34$$

The critical value, at 14 degrees of freedom is 23.685. Thus, the null hypothesis (no significant agreement) cannot be rejected because computed Chi-square value is lower than critical threshold. Therefore, the consensus among profitability, liquidity, and efficiency hierarchy under PCA is insignificant statistically.

3. Comparative Interpretation of PCA and Non-PCA Models

The comparison of both the models brings significant analytical insights:

• Improved Concordance under PCA

The slight bump in W from.415 to.437 implies that statistical weighting marginally improves dimensional alignment, but not enough to be statistically significant.

• Reordering of Firms

Because PCA weighting was used, this meant that some of the firms moved up or down in the ranking when compared to others. Other than indicating some sort of good balance sheet, PCA was also a catalyst that helped improve Grasim Industries. By contrast, firms with extreme variation along each dimension were punished disproportionately.

• Persistence of Dimensional Independence

The statistically non-significant concordance with each of PCA adjustments proves that profitability, liquidity and efficiency still structurally independent in cement sector.

• Validation of Multi-Dimensional Complexity

The minimal agreement on rankings across models further supports the argument that performance alone is not, and cannot be, captured by a single guiding metric in capital-intensive industries.

4. Theoretical and Sectoral Implications

The PCA results would be in line with financial theory having elements that represent trade-offs among return, risk and the operational soundness of the commercial banks. The orientation a firm adopts — whether it is aggressive, seeking growth and efficiency and profitability or conservative, focusing on managing liquidity — can also sort firms in opposite directions in the rankings.

The role of structural features of the cement industry like heavy fixed assets, cyclical nature of demand and working capital intensity in explaining performance heterogeneity is crucial. PCA learns statistical structure in variance but not economic trade-offs, such that there remains a moderate and statistically insignificant concordance over time.

5. Key Findings from PCA-Based Analysis

• Based on a statistically weighted analysis, Grasim Industries emerged as the bestperformer.

• Shree Cement and Ultratech remained at the same positions; but difference in liquidity moved final rank.

There was moderate agreement for PCA-based dimensions (W = 0.437).

• Lack of significant concordance confirmed by Chi-square test.

• Financial performance coefficients survive semi-independently, even by multiple statistical weighting methods.

Most decisively, a PCA-based framework contributes to the robustness of our methodology by avoiding redundancy and

providing data-driven weights. However, the ubiquity of trivial concordance exposes divisional profitability, liquidity and efficiency as structurally distinct yet interrelated attributes of corporate finance. Thus complementing concordance test, global composite models provide a better metric for performant cement sector in its entirety.

Comparative Synthesis of Table 4D-I.1 and Table 4D-I.2

A comparative study of 4D-I Table. 1 (Equal-Weight Composite Ranking Model) and in Tab. 4D -I. The outcome of PCA-based weighted ranking model in 2 indicates bothstructural consistency and methodological sensitivity for evaluating the overall financial performance of cement companies selected. Although the two models differ in their weighting mechanisms, one being a simple average of profitability, liquidity and efficiency, and another using statistical approaches to weight according to variance contribution, the overall performance pattern across firms is similar enough that they reinforce each other resulting in an increased robustness of the analytical framework.

As per equal weight model (Table 4D-I. 1), Ambuja Cement was closely followed by Orient Cement and Shree Cement/JK Cement (joint rank). If this happens it means that the company has performed in all three financial dimensions, without having an excessive reliance on any one indicator. In neurite matrix model, however (Table 4D-I. 2), Grasim Industries shone the brightest, suggesting that using an analytical lens with varying statistical weights points the way to certain financial dimensions weighing more in the final ranking. This change suggests that Grasim is strong on those elements that have more variance-based weight per PCA, despite its relatively lower equal-weight rank in this respect. This kind of methodological repositioning indicates how a bit of shine can shuffle relative standing without changing the ordering of overall performance.

Perhaps not surprisingly, there was some overlap between those companies in each model – indicating that their financial profiles appear to remain structurally intact. (Cardinal segments were defined from model 1 sectors and all firms at those segment levels included in the ranks) Other low-tier firms (like Nuvoco - in red), etc., still willenbind on either ranking benchmark, showing systemic issues on very things that aren't going away3123456789. Similar trends were evident with the mid-tier firms, which ranked rather humbly across both paradigms and experienced only small positional shifts from the differential weighting effects. Such consistency is indeed an important observation in the current context — if extreme differences would have been observed for passing grades, this would have indicated that the evaluation model was unstable.

And even more value is added to their comparative synthesis: the Kendall's Coefficient of Concordance. In Table 4D-I. 1 implies average consistency for the ranks of profitability, liquidity and efficiency (W = 0.415), whereas Table 4D-I. 2, the coefficient rose slightly (W = 0.437). This improves slightly under PCA (not shown), but the Chi-square statistics remain non-significant in either case. That is, consistently low magnitude signals that all three dimensions of the financials lack uniformity in ranking shape across firms regardless of weighting methodology employed. That is, profit leader does not mean liquidity or operating efficiency leader.

Overall, this comparative synthesis demonstrates that although the ranking positions depend on which weighting framework is chosen (i.e. only cement-specific studies get a perfect score), the basic insight remains unchanged: Financial performance in the cement industry is multi-dimensional and shows significantly different structural features. This is good for analytical objectivity in the PCA-based model based on data-driven weights, and at the same time, allowing interpretive simplicity and transparency by equal weight model. Both tables provide complementary pieces of evidence that a common, statistically-appropriate approach is needed to properly assess the financial

performance among business entities in capital-forming industries.

Conclusions

The objective of this study is to evaluate the overall financial performance of selected cement companies based on multidimensional analytical framework covering profitability, liquidity and operational efficiency. The goal is to provide a robust, multivariate, and methodologically rigorous assessment of corporate financial strength through both an equal-weight composite ranking model and a statistically interdependent weighted PCA methodology. Most importantly, another powerful statistical known as Kendall's Coefficient of Concordance was applied to statistically validate the level of agreement between the three financial dimensions.

The empirical evidence supports the multi-dimensional structural heterogeneity of financial performance in cement industry. The equal-weight model detected firms that had more balanced strength across profitably, liquidity and efficiency ranked highest-changing our prior hypothesis we discussed about a performance multi-dimensionality confirming just exactly what with respect to performance was tested while the PCA-based scheme retained largely last place rankings but reversed who fell into first. There would have been slight up or down movements of individual firms due to PCA compliance judgements, but in net the landscape did not change. Companies that consistently scored high on multiple measures remained highly rated and structurally weak companies hit a ceiling in the bottom tier with both models. This concurrent approach is complementary to both evolution and biological analysis, allowing for a greater validity of the method.

Yet, statistical insignificance for Kendall's W statistics and Chi-square values indicated only moderate consensus across profitability, liquidity and efficiency ranks under both models. This conclusion points at the lack of comovement across industries among these financial dimensions without mincing words. More profit does not mean better liquidity, or better return on assets." The lack of statistically significant concordance further supports the position that corporate financial strength cannot be represented with an arbitrarily single measure of performance. What it should, however, strive for is an interlocked framework that encapsulates the nuanced interactions among return generation in one place, resource allocation and financial sustainability over a short time horizon.

This comparative analysis between equal-weight and PCA-based rankings illustrates, as it is all too often the case in Analytics, that results are sensitive to methodological choices. While equal weighting is based only on simple categorization of the target variable, PCA adds a level of objectivity by allowing us to intuitively see how financial variables relate to one another based on their statistical variance. Using either on its own would not have been appropriate and that it is good to use the two models in complement with one another to construct a more rounded evaluation framework. This dual-approach methodology contributes to the broader literature by demonstrating how newly developed composite indices can improve measurement of firm-level financial performance in capital-intense sectors when subjected to statistical evaluations.

These findings practically emphasize that managers, investors and financial analysts need to apply multi-dimensional performance measures rather than only focusing on profitability ones. Thus, a sustainable definition of long-term corporate resilience needs to balance considerations of liquidity control, efficiency gains and return generation on capital. This study helps fill a major gap in the knowledge base for policymakers and regulatory authorities by highlighting analogues to the need for structured financial disclosure, standardized performance metrics, and sector-wide approaches to comparative analysis.

Taken together, the results indicate that overall financial performance in the cement industry tends to be molded by the interplay of several different elements and that each seems to underwrite corporate strength on its own.

Notably, the degree of agreement across these higher order dot points was moderate but not statistically significant suggesting an important role for dimensional variation as a conceptual framework through which performance is assessed. Subsequent studies may expand on this framework through solvency, performance indicators associated with market orientation and environmental sustainability, or longitudinal analysis to ascertain stepwise shifts over time. Such extensions would improve the understanding of corporate performance on multiple fronts, and encourage more informed decision-making in both financial policy and industrial policy settings.

Managerial Implications

This study holds valuable implications in terms of managerial decision making in cement industry. Correlations among profitability, liquidity and efficiency are moderate but statistically insignificant; thus, there is unequivocal evidence that these financial dimensions do not behave serontally. This implies that management should not use profitability indicators as the only measure of overall financial health. So, a company with good returns may at the same time be under liquidity pressures or lack operational efficiency. So, management should adopt a holistic financial discipline which revolves not only around generating returns, but also capital adequacy and asset utilization. Strategic plans must ensure that the management of short-term liquidity does not kill long-term profitability and vice versa.

The focus should increase on working capital management, as liquidity performance is a highly variable element. Cement companies must optimally manage their working capital requirements focusing on reducing inventories, speeding up collections from receivables and streamlining production planning with respect to market demand in order to ensure stable cash flows. As this is a capital-intense industry, marginal improvements in cash cycle management can save financing costs for companies. At the same time, ongoing focus of priority should be around operational efficiency. They should focus on capacity utilization, cost control, energy efficiency and tech modernization to drive higher asset turnover and productivity. To measure the firm performance on key financial drivers in comparison with industry peers, firms thus should look to approach data-driven decision making and ideally using statistically inferential techniques. Capital structure management is even more pertinent during cyclical downturns where the balance between leverage and financial security matters.

Policy Recommendations

On a policy perspective, the paper highlights the need for increased transparency/ standardization in financial reporting regarding cement sector. Regulatory bodies like SEBI may then promote structured multi-dimensional disclosure frameworks which contain profitability, liquidity as well as efficiency and solvency indicators. Standardized reporting would enhance comparability between firms as well organisations and lessens the asymmetry of information in property capital markets. Through fiscal incentives, policymakers can also encourage technological upgradation and energy efficient production process which in turn will enhance operational efficiency as well as sustainability of the environment.

Financial institutions may need to adopt composite financial evaluation models at the time of credit appraisal instead of placing too much reliance on profitability measures. What banks need are liquidity and efficiency indicators to better assess risk so they can lend accordingly. In addition, industry associations can create integrated benchmarking indices using multi-dimensional performance measures to help their firms identify where they need improvement and stimulate competitive enhancement in this perspective. These policy initiatives, if collectively taken, would foster financial discipline in the cement sector leading to industrial stability and sustainable growth.

Conflict of interest

The authors declare that they have no known competing financial interests or personal

relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors sincerely acknowledge Capitaline Corporate Database, Capital Market Publishers (India) Ltd., Mumbai, for providing valuable data and resources that have significantly contributed to this work.

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Table 4D-I.1-Computation of Ranking of Different Measures of Overall Financial Performance of the Selected Cement Industries

COMPANY	ULTIMATE PROFITABILITY RANK(UPR)	ULTIMATE LIQUIDITY RANK(ULR)	ULTIMATE EFFICIENCY RANK(UER)	SUM OF RANKS	ULTIMATE RANK
Ultratech	1.5	11	3	15.5	5
Grasim Industries	4	12.5	10.5	27	9.5
Ambuja Cement	3	7	2	12	1
Shree Cement	1.5	5	7	13.5	3.5
Acc Cement	7.5	14	4	25.5	7
Dalmia	11.5	10	10.5	32	12
JK Cement	7.5	1	5	13.5	3.5
Ramco Cement	6	4	12	22	6
Nuvoco	13.5	12.5	13	39	15
JK Lakshmi Cement	11.5	15	6	32.5	13
India cement	15	3	15	33	14
Star Cement	5	8	14	27	9.5
Heidelberg	9	9	8.5	26.5	8
Orient Cement	10	2	1	13	2
Sagar Cement	13.5	6	8.5	28	11
The Kendall's coefficient of concordance (W) calculated for the three sets of financial performance measures, based on their average values, is **0.415.** The corresponding Chi-square (χ^2) value for W is **17.43** (critical value is **23.685**), which is found to be statistically insignificant.					

Source: compiled and computed from Capitaline Corporate Database, Capital Market Publishers(India) Ltd.,Mumbai

Table 4D-I.2-Computation of Ranking of Different Measures of Overall Financial Performance of the Selected Cement Industries under PCA

COMPANY	ULTIMATE PROFITABILITY RANK(PCA)	ULTIMATE LIQUIDITY RANK(PCA)	ULTIMATE EFFICIENCY RANK(PCA)	SUM OF RANKS	ULTIMATE RANK
Ultratech	1.00	15.00	2.00	18	3
Grasim Industries	3.50	3.50	3.00	10	1
Ambuja Cement	3.50	9.00	13.00	25.5	10.5
Shree Cement	2.00	2.00	8.00	12	2
Acc Cement	8.00	6.00	7.00	21	7
Dalmia	12.50	7.00	13.00	32.5	12
JK Cement	6.50	1.00	13.00	20.5	6
Ramco Cement	12.50	12.00	1.00	25.5	10.5
Nuvoco	14.00	13.50	10.50	38	14
JK Lakshmi Cement	10.00	8.00	4.00	22	9
India cement	9.00	5.00	6.00	20	5
Star Cement	5.00	3.50	10.50	19	4
Heidelberg	11.00	13.50	9.00	33.5	13
Orient Cement	6.50	10.00	5.00	21.5	8
Sagar Cement	15.00	11.00	15.00	41	15
The Kendall's coefficient of concordance (W) calculated for the three sets of financial performance measures, based on their average values, is **0.437.** The corresponding Chi-square (χ^2) value for W is **18.34** (critical value is **23.685**), which is found to be statistically insignificant.					

Source: compiled and computed from Capitaline Corporate Database, Capital Market Publishers(India) Ltd.,Mumbai