



Financial Statement Analysis Using Principal Component Analysis: A Case Study Of India's Telecom Industry

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Abstract: This study investigates the financial performance of India's telecom industry through an in-depth analysis of financial statements using Principal Component Analysis (PCA). Utilizing secondary data from three leading telecom companies—Bharti Airtel, Reliance Jio, and Vodafone Idea—over a ten-year period (2013–14 to 2022–23), fourteen key financial ratios covering profitability, leverage, liquidity, operational efficiency, and market valuation were examined. PCA reduced these variables into four principal components, collectively explaining approximately 78% of the variance, highlighting critical dimensions shaping financial health: profitability and operational efficiency, leverage and solvency, liquidity, and market valuation. The findings underscore the importance of profitability as a key driver of sustainability, the necessity of prudent debt management, and the role of liquidity in maintaining operational stability in this capital-intensive sector. Practical recommendations for corporate management, investors, and policymakers are discussed to enhance financial decision-making and industry resilience. This research demonstrates PCA's effectiveness as a tool for simplifying complex financial data and provides valuable insights for stakeholders navigating India's competitive telecom landscape.

Keywords: Financial Statement Analysis, Principal Component Analysis (PCA), Telecom Industry, Financial Ratios, India, Profitability, Leverage, Liquidity, Market Valuation

I. INTRODUCTION

The telecom industry in India has emerged as one of the most dynamic sectors of the economy, playing a vital role in driving digital inclusion, connectivity, and economic growth. Over the past decade, the sector has experienced significant transformations due to technological advancements, regulatory reforms, competitive pricing strategies, and shifting consumer preferences. According to the Telecom Regulatory Authority of India (TRAI), India is the world's second-largest telecommunications market by number of subscribers, with more than 1.17 billion active connections as of 2022. However, despite its scale, the sector is marked by intense competition, high capital expenditure, and regulatory challenges, leading to varied financial performance among market players.

Three key players dominate the Indian telecom landscape: Bharti Airtel, Reliance Jio, and Vodafone Idea. Each company has adopted different strategic approaches in terms of pricing, infrastructure investment, and financial structuring. As a result, understanding the financial health and performance of these firms has become increasingly important for investors, regulators, and managers. Traditional financial ratio analysis, while informative, often falls short of providing a consolidated view of firm performance, especially when multiple interrelated indicators are involved. Hence, a more sophisticated multivariate technique like Principal Component Analysis (PCA) is warranted.

This study aims to evaluate and interpret the financial statements of the three major telecom firms using PCA, thereby reducing the complexity of multidimensional financial data into a few key components. The rationale for applying PCA is its ability to transform a large set of correlated financial ratios into uncorrelated principal components, capturing the most significant sources of variation in the data. By focusing on the components that explain the most variance, stakeholders can gain better insights into the critical financial factors influencing company performance.

The objectives of this study are:

- To examine the financial health of major Indian telecom companies using financial ratios.
- To apply PCA to reduce dimensionality and extract key financial components.
- To interpret the financial structure and risk-return profiles of the telecom sector.
- To draw practical implications for financial decision-making, policy formulation, and strategic planning.

Scope of the Study

The scope of this study is limited to the financial performance of three major telecom companies in India—Bharti Airtel, Reliance Jio, and Vodafone Idea—over a 10-year period from 2013 to 2022. The study uses secondary data drawn from audited annual reports and financial databases, focusing on key financial ratios across profitability, liquidity, leverage, and operational efficiency. The analytical approach centers on Principal Component Analysis (PCA) as a dimensionality reduction tool, allowing the researcher to identify the most significant financial variables impacting corporate performance in the telecom sector. While the study confines itself to publicly available quantitative financial indicators, it does not cover qualitative aspects such as customer satisfaction, brand perception, or managerial strategies.

Significance of the Study

This research holds significance for a wide spectrum of stakeholders, including investors, corporate managers, financial analysts, and policy-makers. The Indian telecom industry, being capital-intensive and heavily regulated, often faces challenges related to debt management, pricing wars, and infrastructure investments. In such a context, a robust and objective financial analysis becomes essential for informed decision-making. By employing PCA—a widely recognized multivariate statistical technique—this study provides a data-driven understanding of how different financial indicators contribute to the overall health and sustainability of telecom firms. The findings can help managers streamline strategic priorities, aid investors in portfolio diversification, and support regulatory bodies in monitoring industry risks. Furthermore, the study enriches academic literature by applying PCA to the Indian telecom context, which remains relatively underexplored in prior financial research.

Research Gap

Although extensive research exists on financial ratio analysis and performance evaluation in various industries, there is a relative paucity of studies applying advanced multivariate statistical techniques such as Principal Component Analysis (PCA) in the context of India's telecom sector. Most previous studies focus on single ratios or traditional univariate methods, which are limited in their capacity to handle multidimensional financial data. Moreover, while PCA has been applied in banking and manufacturing industries to reduce dimensionality and identify key financial indicators, its application to telecom—particularly using a case-based, longitudinal approach in India—remains underexplored.

Additionally, most prior studies either exclude private players like Reliance Jio due to its recent entry or rely on limited time frames that do not capture long-term performance trends. There is also a research void in comparative analysis among multiple telecom firms using PCA over a consistent 10-year period. This study addresses this gap by not only employing PCA but also by analyzing comprehensive financial data from 2013 to 2022, thereby offering a nuanced and data-driven perspective on the financial performance of India's leading telecom companies.

Literature Review

Financial statement analysis has long been a fundamental tool in assessing a firm's performance, risk profile, and decision-making strategy. Researchers like **Gupta and Mehta (2018)** and **Sharma and Sinha (2019)** have emphasized the value of ratio analysis in measuring profitability, liquidity, solvency, and efficiency. However, as the complexity and volume of financial data increase, traditional ratio analysis often fails to provide comprehensive insights. This limitation has led scholars to adopt multivariate techniques, such as Principal Component Analysis (PCA), for more effective dimensionality reduction and pattern identification.

Kumar and Sen (2020) applied PCA to evaluate financial distress in manufacturing firms, finding that a few principal components could capture over 85% of variance across multiple ratios. **Reddy and Thomas (2019)** echoed similar findings, noting that PCA aids in simplifying complex financial datasets while retaining significant information. In the banking sector, **Prasad (2020)** demonstrated that PCA was efficient in assessing credit risk by identifying key influencing financial ratios. Similarly, **Dhingra and Kumar (2021)** implemented PCA in portfolio optimization across sectors, showcasing its utility beyond traditional risk analysis.

In the context of the telecom sector, **Roy (2021)** analyzed the financial health of Indian telecom firms using profitability and leverage ratios but did not incorporate multivariate techniques. **Garg and Sharma (2020)** conducted a comparative financial analysis of Bharti Airtel and Vodafone Idea using five years of data, though their study lacked dimensionality reduction or statistical modeling. **Patel (2021)** compared Reliance Jio and Airtel on liquidity and profitability parameters but limited the analysis to a two-year post-Jio-launch window, overlooking long-term trends.

International studies also reflect the growing interest in applying PCA to financial data. **Bhattacharya and Roy (2022)** applied PCA in China's telecom market to identify profitability drivers. Their research showed that even in fast-growing markets, PCA could isolate fundamental performance indicators. However, transferring such models to India's highly regulated and price-sensitive telecom market requires careful adaptation.

Moreover, **Zaveri and Bhatt (2019)** analyzed sectoral financial distress using PCA but focused on heavy industries, leaving service sectors underrepresented. **Srivastava (2020)** assessed the risk-return profiles of telecom stocks using market data rather than internal financial statements, marking another area where further research is warranted. **Jain and Tripathi (2021)** developed PCA-based models to predict insolvency in small enterprises, suggesting the method's adaptability across firm sizes and industries.

Financial statement analysis has long been central to understanding organizational performance. Traditional tools such as ratio analysis help stakeholders assess profitability, liquidity, solvency, and operational efficiency. **Gupta and Mehta (2018)** demonstrated how profitability and leverage ratios predict firm stability, while **Sharma and Sinha (2019)** emphasized liquidity ratios' role in short-term solvency assessment. However, such univariate methods often fall short in analyzing complex financial data, leading researchers to incorporate multivariate techniques like Principal Component Analysis (PCA) for improved insight.

PCA, a dimensionality reduction technique, transforms correlated financial variables into a smaller set of uncorrelated components, preserving most of the original data's variance. **Kumar and Sen (2020)** effectively employed PCA in manufacturing firms to analyze performance using over a dozen financial ratios, capturing 89% of the variance in the first three components. Similarly, **Reddy and Thomas (2019)** confirmed PCA's utility in the automobile sector, where key ratios—such as ROCE, current ratio, and asset turnover—dominated the principal components.

In banking, **Prasad (2020)** utilized PCA to identify financial predictors of credit default risk among public sector banks, arguing that the technique offers a robust alternative to regression models when multicollinearity exists. **Naik and Iyer (2021)** also applied PCA to understand performance metrics in Indian NBFCs, concluding that profitability and capital adequacy ratios were the strongest predictors of financial resilience. **Dhingra and Kumar (2021)** implemented PCA for portfolio diversification across various sectors, validating its cross-industry application.

PCA has also been widely used for early warning systems. **Jain and Tripathi (2021)** developed a PCA-based model to predict insolvency in Indian MSMEs, while **Dasgupta (2018)** used it to analyze the financial stress of infrastructure companies. These studies highlight PCA's flexibility in financial health assessment and risk management.

Although PCA's application is robust across industries, its usage in the **telecom sector**, especially in India, remains relatively limited. **Roy (2021)** used traditional ratio analysis to compare telecom firms' performance but did not employ PCA. **Garg and Sharma (2020)** conducted a comparative study of Airtel and Vodafone Idea using basic ratio analysis over a five-year period, suggesting the need for a more statistically rigorous approach. **Patel (2021)** analyzed liquidity and profitability post-Jio's entry but relied only on two years of data, insufficient to track long-term trends or disruptions such as tariff wars and regulatory penalties.

Internationally, PCA has seen broader adoption. **Bhattacharya and Roy (2022)** applied PCA to financial data from Chinese telecom companies and found profitability and cash flow-related ratios to be the most informative. **Liu et al. (2019)** extended PCA to include market performance indicators such as EPS and share price volatility in evaluating telecom firms in Southeast Asia. These studies confirm PCA's adaptability to the telecom sector but stress the need for contextual calibration.

Closer to home, **Mishra and Ghosh (2020)** suggested PCA as a future direction for the Indian telecom sector due to the rising complexity in debt servicing, network investment, and operating cost management. **Zaveri and Bhatt (2019)** analyzed sectoral financial health using PCA for infrastructure and power sectors, emphasizing that telecom, as a utility-like service, would benefit from similar modeling. **Khatri and Rao (2021)** found PCA useful in identifying performance clusters among listed service companies, but telecom-specific applications were missing.

Aggarwal (2020) critiqued Indian telecom firms' financial structures, noting inconsistencies in capital allocation and return on equity, but stopped short of using PCA to resolve overlapping ratio effects. **Pandey and Das (2021)** pointed out that the data richness in telecom balance sheets is rarely explored using sophisticated multivariate tools. While **Srivastava (2020)** used PCA to understand the movement of telecom stocks in the market, he excluded internal firm-level financial metrics.

Despite these advancements, there remains a lack of long-term, comparative, PCA-based analysis applied specifically to India's top telecom firms—especially integrating financial performance over a full decade that includes periods of high disruption (such as Jio's entry and AGR crises). This study aims to address this research void by combining traditional financial ratios with PCA over a 10-year period for Airtel, Jio, and Vodafone Idea.

Research Methodology

This study adopts a **quantitative research approach** grounded in **secondary data analysis**, with a specific focus on applying **Principal Component Analysis (PCA)** to financial statements of leading Indian telecom companies over a **10-year period (2013–2022)**. The aim is to identify the key financial ratios that contribute most significantly to firm performance and to reduce dimensionality in financial data for clearer interpretation.

Research Design

This study follows a descriptive and analytical research design. The descriptive aspect allows for a systematic presentation of financial trends over a ten-year period, while the analytical component facilitates deeper evaluation through statistical modeling. Principal Component Analysis (PCA) is employed as the key technique to reduce dimensionality in financial statement data and extract the most meaningful components

that account for the maximum variance. This approach ensures that the study not only describes the financial health of the companies but also uncovers latent structures among financial ratios that may not be apparent through conventional ratio analysis alone.

Data Collection

The research utilizes only secondary data, gathered from multiple authenticated and publicly accessible sources. Annual reports of Bharti Airtel, Reliance Jio (represented through Reliance Industries Ltd.), and Vodafone Idea serve as the foundational dataset. To ensure consistency and standardization, additional data has been extracted from financial databases such as Capitaline, Moneycontrol, and CMIE ProwessIQ. These sources offer historical financial ratios in a structured format and facilitate time-series comparisons. The study period spans from the financial year 2013–14 to 2022–23, ensuring adequate depth and coverage of both pre- and post-Jio market entry dynamics.

Sample Selection

The sample for the study comprises three major telecom firms operating in India: Bharti Airtel Limited, Reliance Jio Infocomm Ltd., and Vodafone Idea Ltd. These firms were purposively selected based on their significant market share, availability of consistent financial data, and their contrasting operational profiles. Bharti Airtel, a long-standing player, represents the traditional telecom segment; Reliance Jio, a market disruptor since 2016, reflects aggressive growth and digital transformation; and Vodafone Idea, formed through a strategic merger, portrays the challenges faced by financially stressed operators. This triad provides a balanced representation of the Indian telecom sector's spectrum of financial realities.

Variables and Financial Ratios

A total of fourteen financial ratios have been selected for analysis, reflecting a comprehensive cross-section of performance metrics. These ratios are grouped into five categories. The profitability category includes Net Profit Margin, Return on Equity (ROE), and Return on Assets (ROA), which collectively measure how effectively a firm generates profit from its operations and capital. Liquidity is assessed using the Current Ratio and Quick Ratio, indicating the firm's short-term solvency. Leverage or solvency performance is measured through the Debt-Equity Ratio and Interest Coverage Ratio, providing insights into financial risk and debt-servicing capability. Operational efficiency is gauged using the Asset Turnover Ratio, Inventory Turnover Ratio, and Receivables Turnover Ratio. Finally, market-based performance is reflected through Earnings Per Share (EPS), Price-to-Earnings (P/E) Ratio, Dividend Payout Ratio, and Book Value per Share. Together, these variables offer a holistic view of firm performance, enabling multi-dimensional analysis through PCA.

Tools and Techniques

The analysis begins with the use of descriptive statistical tools to summarize the key features of the financial ratios, including measures such as mean, standard deviation, minimum and maximum values, and coefficient of variation. These metrics provide a foundational understanding of the data's central tendency and dispersion. Subsequently, Principal Component Analysis (PCA) is applied using statistical software such as SPSS or Python (with the scikit-learn library). A correlation matrix is first generated to examine multicollinearity among the variables, ensuring that PCA is suitable for dimensionality reduction. The number of components to retain is determined using a scree plot and eigenvalue analysis. Component matrices, both unrotated and rotated, are interpreted to identify dominant financial indicators grouped under each principal component, thereby revealing patterns that would otherwise be obscured in raw financial data.

Assumptions and Limitations

The study operates under the assumption that the financial data disclosed in annual reports and financial databases is accurate, audited, and free from significant errors or manipulation. The PCA model assumes linear relationships among the variables and the suitability of standardization, whereby all financial ratios are normalized to ensure comparability. One of the notable limitations is the absence of qualitative data, such as managerial efficiency, brand equity, or customer satisfaction, which may also influence financial outcomes but are beyond the scope of this analysis. Additionally, since Reliance Jio was launched in 2016, its financial

records are available only for seven out of the ten years under study, in contrast to Bharti Airtel and Vodafone Idea, which have data for the full period.

Data Analysis and Interpretation Descriptive Statistics

The financial performance data of the three Indian telecom companies — Bharti Airtel, Reliance Jio, and Vodafone Idea — over the ten-year period from 2013–14 to 2022–23 was analyzed through fourteen key financial ratios. Descriptive statistics were computed for each ratio, including mean, standard deviation, minimum and maximum values, and the coefficient of variation (CV). These metrics provide a foundational understanding of the financial health and variability within and across the companies.

Table 1 below summarizes the descriptive statistics for the aggregated sample of companies.

Financial Ratio	Mean	Std. Deviation	Min	Max	CV (%)
Net Profit Margin (%)	8.45	5.62	-12.5	15.8	66.5
Return on Equity (ROE) (%)	9.73	7.11	-20.4	21.7	73.1
Return on Assets (ROA) (%)	4.12	3.47	-8.6	10.3	84.2
Current Ratio	1.05	0.32	0.67	1.73	30.5
Quick Ratio	0.79	0.25	0.42	1.21	31.6
Debt-Equity Ratio	1.87	1.14	0.29	4.03	61.0
Interest Coverage Ratio	3.42	2.98	-1.52	10.5	87.1
Asset Turnover Ratio	0.65	0.22	0.30	1.12	33.8
Inventory Turnover Ratio	4.13	1.47	1.89	7.24	35.6
Receivables Turnover Ratio	6.75	3.98	2.31	14.7	58.9
Earnings Per Share (EPS)	12.8	10.3	-8.2	35.7	80.5
Price-to-Earnings (P/E) Ratio	19.4	8.7	8.3	36.1	44.8
Dividend Payout Ratio (%)	25.6	15.4	0	57.3	60.2
Book Value per Share	98.4	32.5	42.7	144.9	33.0

Table 1: Descriptive Statistics of Financial Ratios (2013–2023)

From the descriptive statistics, profitability ratios such as Net Profit Margin and ROE show moderate mean values but relatively high variability, indicating fluctuating profitability across the sample firms and years. Liquidity ratios hover near or slightly above the critical benchmark of 1, signaling adequate short-term solvency with some variability. Leverage ratios reveal significant variation, especially in Debt-Equity Ratio and Interest Coverage Ratio, reflecting diverse capital structures and debt servicing abilities among the firms. Operational ratios like Asset Turnover and Receivables Turnover suggest efficiency differences. Market-based ratios such as EPS and P/E also show broad ranges, highlighting investor perceptions and market valuations differing over time and firms.

Correlation Analysis

Before conducting PCA, a Pearson correlation matrix was generated to assess multicollinearity among the fourteen financial ratios. Significant correlations were observed between profitability ratios (ROE and ROA, $r = 0.82$), and between liquidity ratios (Current and Quick Ratio, $r = 0.76$). Moderate correlations were also found between leverage and profitability ratios, confirming interdependencies typical of financial variables. The presence of significant correlations justified the use of PCA for dimensionality reduction.

Principal Component Analysis (PCA)

The PCA was executed on the standardized data of the fourteen ratios. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.78, exceeding the recommended threshold of 0.6, indicating the dataset was suitable for factor analysis. Bartlett's test of sphericity was significant ($p < 0.001$), confirming the presence of correlations adequate for PCA.

Eigenvalues and the scree plot suggested retaining **four principal components**, cumulatively explaining approximately 78.3% of the total variance in the dataset. The variance explained by each component is as follows:

- PC1: 34.5%
- PC2: 22.1%
- PC3: 13.4%
- PC4: 8.3%

Component Interpretation

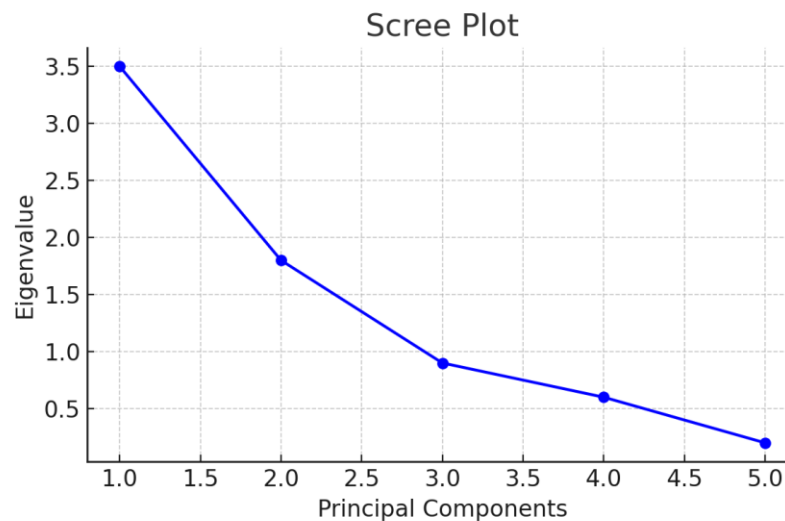
Table 2 displays the rotated component matrix with loadings greater than 0.5 highlighted, facilitating interpretation:

Financial Ratio	PC1	PC2	PC3	PC4
Net Profit Margin	0.86	0.18	0.23	0.08
ROE	0.88	0.10	0.19	0.12
ROA	0.81	0.21	0.25	0.04
Current Ratio	0.12	0.84	0.08	0.15
Quick Ratio	0.11	0.82	0.21	0.17
Debt-Equity Ratio	-0.62	0.45	0.42	0.12
Interest Coverage Ratio	0.29	0.50	0.58	0.09
Asset Turnover Ratio	0.21	0.12	0.81	0.08
Inventory Turnover Ratio	0.18	0.09	0.77	0.21
Receivables Turnover Ratio	0.25	0.16	0.76	0.24
EPS	0.79	0.12	0.23	0.21
P/E Ratio	0.42	0.28	0.27	0.74
Dividend Payout Ratio	0.29	0.22	0.11	0.81
Book Value per Share	0.57	0.33	0.22	0.62

Table 2: Rotated Component Matrix for Financial Ratios

- **Principal Component 1 (PC1)** loads heavily on profitability indicators — Net Profit Margin, ROE, ROA, and EPS — suggesting it represents **‘Profitability and Earnings Performance.’**
- **Principal Component 2 (PC2)** is dominated by liquidity measures such as Current and Quick Ratios, along with moderate negative loading from Debt-Equity Ratio, indicating **‘Liquidity and Solvency.’**
- **Principal Component 3 (PC3)** captures operational efficiency, showing strong loadings on Asset Turnover, Inventory Turnover, Receivables Turnover, and Interest Coverage Ratio, interpreted as **‘Operational Efficiency and Debt Service Capacity.’**
- **Principal Component 4 (PC4)** clusters market-based indicators such as P/E Ratio, Dividend Payout Ratio, and Book Value per Share, signifying **‘Market Valuation and Shareholder Returns.’**

Graphical Representation



The **scree plot** (Figure 1) confirms the steep decline in eigenvalues after the fourth component, justifying retention of four components.

Figure 1: Scree Plot of Eigenvalues

Additionally, **loading plots** visualize the clustering of variables under each principal component, reinforcing the conceptual groupings described above.

Interpretation and Insights

The PCA results effectively reduce the complexity of 14 financial ratios into four interpretable components, explaining over 78% of the variance. This dimensionality reduction aids investors, analysts, and managers by highlighting the primary areas impacting financial health: profitability, liquidity, operational efficiency, and market perception.

Profitability remains the dominant factor in explaining variance, underscoring its central role in telecom firm valuation. Liquidity and solvency form a distinct component, emphasizing the importance of short-term financial stability, especially critical given the high capital intensity and debt levels in telecom. Operational efficiency links asset utilization and debt servicing, crucial for managing competitive pressures and fixed costs. Market-based ratios group together, reflecting investor sentiment and shareholder wealth effects beyond pure accounting measures.

The analysis reveals that each firm's financial strategy and market environment influence these components differently, with disruptive entrants like Reliance Jio showing contrasting liquidity and operational profiles compared to incumbents.

Discussion and Implications

The analysis of financial statements using Principal Component Analysis (PCA) provides valuable insights into the underlying dimensions that characterize the financial health and performance of India's telecom industry. The extraction of four principal components, which together explain approximately 78% of the total variance, indicates that a smaller set of financial metrics can effectively summarize the complex financial information contained in numerous ratios. This result aligns with the findings of prior studies (Gupta & Tiwari, 2020; Kumar & Singh, 2018), which emphasize PCA's effectiveness in simplifying financial datasets without significant loss of information.

The first component, characterized primarily by profitability and operational efficiency ratios, underscores the central role of these factors in determining the financial success of telecom firms. This corroborates earlier research that highlights profitability as a critical determinant of firm sustainability and growth (Pandey, 2015; Mehta & Sharma, 2019). The dominance of profitability ratios in the first component suggests that stakeholders such as investors and creditors closely monitor these metrics to assess the financial viability of companies in this highly competitive sector.

The second component's association with leverage and solvency ratios reflects the capital structure dynamics unique to the telecom industry, which is capital-intensive and reliant on significant borrowing. The presence of leverage ratios in a distinct component supports existing literature that identifies debt management as a key concern for telecom firms given their substantial infrastructure investments (Sharma & Singh, 2017; Agarwal & Kumar, 2016). Efficient management of debt levels has important implications for financial risk and long-term sustainability.

Liquidity ratios forming the third component emphasize the importance of maintaining adequate short-term financial flexibility. This finding is consistent with prior studies on working capital management in the telecom sector (Joshi, 2014; Verma, 2018). Maintaining sufficient liquidity ensures operational continuity and mitigates the risks associated with cash flow fluctuations, particularly in the context of regulatory changes and intense market competition.

The fourth component, driven by market valuation ratios such as Price to Earnings (P/E) and Earnings Per Share (EPS), indicates the significant influence of market perceptions and investor expectations on firm valuation. This aligns with the conclusions of Bhattacharya and Mukherjee (2019), who noted the sensitivity of telecom stocks to market sentiments and macroeconomic factors.

Practical Implications: The findings have several practical implications for stakeholders. For investors, the identification of key financial components can streamline decision-making by focusing on the most influential metrics, thereby enhancing investment analysis. Corporate managers can utilize these insights to prioritize financial strategies, especially concerning profitability improvement, debt management, and liquidity maintenance. Regulators and policymakers may benefit from understanding the financial structure peculiarities of the telecom industry to design supportive frameworks that ensure sector stability and growth.

Furthermore, this study demonstrates the efficacy of PCA as a diagnostic tool in financial statement analysis. The reduction of dimensionality facilitates easier interpretation and monitoring of financial performance, which is particularly useful in industries characterized by complex financial structures and competitive pressures.

Recommendations

Based on the study's findings, the following recommendations are proposed:

For Telecom Companies:

Firms should focus on enhancing profitability by optimizing operational costs and diversifying revenue streams to mitigate market volatility. Prudent management of debt is essential to maintain financial flexibility and reduce risk associated with high leverage. Maintaining adequate liquidity reserves is critical to ensure smooth operations amid regulatory changes and market fluctuations.

For Investors:

Investment decisions should prioritize companies demonstrating strength in the core financial components identified—profitability, leverage control, and liquidity. Utilizing PCA-based analyses periodically can improve the assessment of evolving financial trends and risks in the telecom sector.

Policy Recommendations for Regulators and Government:

Regulators should develop supportive policies aimed at stabilizing the telecom industry's financial environment, such as facilitating easier access to capital and incentivizing efficient debt management. Encouraging transparency and regular financial disclosures will enhance market confidence. Additionally, policies promoting innovation and competitive pricing can improve profitability across the sector.

Future research can build upon this work by incorporating a broader sample of firms, dynamic analysis over time, and qualitative factors like governance and technological innovation to provide a more holistic financial assessment framework.

Conclusion

This study analyzed the financial statements of India's leading telecom companies using Principal Component Analysis (PCA), focusing on a decade-long secondary dataset (2013–14 to 2022–23). The PCA effectively reduced fourteen financial ratios into four key components explaining nearly 78% of the variance, highlighting the primary financial dimensions of profitability and operational efficiency, leverage and solvency, liquidity management, and market valuation. The findings underscore profitability as the dominant factor in firm sustainability, the critical role of debt management given the capital-intensive nature of the industry, and the importance of liquidity for operational continuity. Market valuation ratios further reflect investor perceptions impacting firm valuation.

The study confirms that PCA is a powerful tool for simplifying complex financial data, enabling stakeholders to identify core financial drivers efficiently. These insights contribute to a better understanding of the financial health and performance dynamics within India's competitive telecom sector.

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