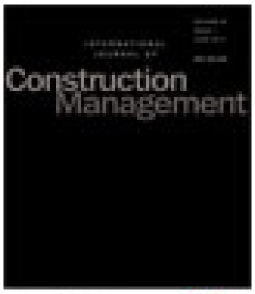

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Identification of significant financial performance indicators for the Indian construction companies

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ABSTRACT

Financial ratio analysis has been instrumental over the years to evaluate the financial state of construction companies. However, such an analysis is tedious owing to the presence of a large number of financial ratios corresponding to different construction companies. Therefore, the purpose of this study is to identify the significant financial performance factors (SFPFs) for construction companies. A stratified sampling technique was adopted and the list of companies pertaining to the construction industry was prepared on the basis of scope, sub-sectors, age, enlistment at the national stock exchange, and most importantly the availability of financial statements for last ten years. The data pertaining to financial statements for last 10 years was collected from Capitaline database. In this study, a mixed approach (qualitative and quantitative) has been used involving factor analysis on financial ratios of 100 Indian construction companies over the period of ten years (2008–17) for determining the key factors which govern the financial performance of the companies. A total of five SFPFs were identified, namely investor return, business efficiency, operations management, activity efficiency and risk coverage, and asset management. Further, relative importance of each of these factors was determined by means of percentage explanation of variance respectively. These SFPFs can provide important relevant information about the financial performance of the company. This will help the company and its related stakeholders in better planning of its strategies and policies by focusing on a few important areas for overall improvement of the company. This may further lead to develop a financial performance evaluation framework to evaluate and improve financial performance of construction companies.

KEYWORDS

Construction industry; factor analysis; financial crisis; financial performance factors; financial ratios

Introduction

The construction industry is the second largest employer in India and a major contributor to the economic activity, after the agriculture sector (Enshassi et al. 2010). It accounts for the second highest inflow of foreign direct investment (FDI) after the services sector. Also, it directly affects about 200 other sectors and employed more than 41 million people in 2011 with the expectation of adding 60 million job opportunities by 2022 (Tripathi and Jha 2017). Laskar and Murty (2004) threw light on the economic importance of the Indian construction sector buttressed by the fact that every INR 1 investment in the construction industry leads to an increment of INR 0.80 in the gross domestic product (GDP) as compared to the increments of INR 0.20 and 0.14 in the GDP for agriculture and manufacturing industries respectively.

Vinod and Kaushik (2007) compared and analysed the growth rate of GDP versus construction sector growth rate in India for 45 years (1960–2005). The researchers observed that often the fall in the growth of construction sector output precedes the fall in the growth of GDP. This observation implied that the poor and dismal performance of the construction sector played a substantial role in the decline of the growth rate of GDP in the subsequent periods. This conclusion is also in line with the work of Leamer (2007), who studied the role of housing and found it to be a significant contributor to the US business cycles. The findings of Leamer (2007) were based on the fact that housing consists of volume cycle instead of a price cycle and drop in sales volume is preceded by a decline in the availability of jobs leading to a decline in the overall output of the US economy.

The discussions above underline the importance of the growth of construction sector in the growth of the Indian economy. The average annual contribution of the construction sector is about 8% in the GDP (CSO (Central Statistics Office) 2014). However, in recent times, the Indian economy has been hit by various economic crises such as the global financial crisis in 2008 and the Asian financial crisis in 2014. Moreover, the initial phases of the introduction of demonetisation and goods and services tax (GST) have been unsettling for the economy. Consequently, the GDP of India has fallen from 8.0% in 2015–16 to 7.1% in 2016–17 (Economic Survey 2018) to 6.8% in 2018–19.

Hence, it is the quintessential need of the hour that the government and related stakeholders analyse the significant factors that influence the financial state of the construction companies and accordingly undertake adequate steps to boost the construction activities (Soewin and Chinda 2020). This requires a detailed financial analysis of the construction companies.

Financial ratio analysis has been instrumental over the years to provide a holistic viewpoint of the financial position of a company at any moment or period of time (Muresan and Wolitzer 2004). A financial ratio refers to the quotient of various selected account values belonging to a firm's financial statements such as

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balance sheet, income statement, cash flow statement, etc. Some of the examples of financial ratios are fixed assets turnover ratio, current ratio, return on equity, and debtors turnover ratio. These ratios are used by the managerial staff within the company, shareholders, company's investors, business analysts and government authorities to assess and compare the financial performance of various companies. They are instrumental in the quantification of various aspects of business and hence are deemed inevitable for the financial analysis (Tripathi et al. 2019). There are more than 50 financial ratios that cover various aspects of the business undertaken by the company. However, some are more significant than others in the determination of the financial state of the company (Sinesilassie et al. 2018). This significance varies from one industry to other and also from one country to other due to various economic factors (Gombola and Ketz 1983; Cinca et al. 2005). It is impractical to take into account all the ratios every time for assessing the financial state of an industry owing to the presence of a large number of companies pertaining to a specific industry. Moreover, no one ratio describes the full information about the company, whereas the random combination of ratios may lead to redundancy in the information. Thus, there is a need to find out the significant ratios pertaining to the Indian construction companies and consequently identify significant factors that influence the growth of the Indian construction companies. In this study, these significant factors are termed as 'significant financial performance factors (SFPFs)' because these factors indicate about the crucial financial aspects that affect the companies and may prove to be instrumental in assessing the financial state of the Indian construction companies.

Traditionally, the financial ratios have been categorised broadly into four categories, namely liquidity ratios, solvency ratios, activity ratios, and profitability ratios (Paramasivan and Subramanian 2008). However, this traditional categorisation of ratios has been done based on assumed relationships rather than empirical evidence. Öcal et al. (2007) stressed the need for an inductive approach which involves a classification based on statistical techniques. The use of such statistical techniques has grown and gained momentum over the years. For this purpose, factor analysis is one of the most widely used statistical techniques (De et al. 2011) which uses the interrelationships among a large number of variables in terms of common underlying hypothetical variables with a minimum loss of information (Hair et al. 2009). Thus, financial factors for the Indian construction companies can also be determined by performing factor analysis on the financial ratios of the Indian construction companies. There is a lack of studies on financial ratios which try to identify the significant financial performance factors in the context of Indian construction companies which employs a huge population. Also, empirical evidence from earlier studies indicate that financial ratio patterns vary from industry to industry, for e.g., between retail and manufacturing firms (Gombola and Ketz 1983). Therefore, financial factors obtained by factor analysis done for some other industry will not be applicable to the Indian construction companies. Thus, there was a need to abridge this research gap by striving to identify financial performance factors of the construction companies of developing countries such as India.

In this study, factor analysis approach has been applied on the financial ratios of 100 Indian construction companies over the period of ten years (2008–17) for determining the key factors which govern the financial performance of the Indian construction companies. Thus, this paper aims to identify the SFPFs which, in turn, can be used to assess the financial performance of the Indian construction companies. Identification of SFPFs will assist the company owners, the investors, business analysts, and the government to focus on fewer relevant factors that govern the performance instead of a large pool of ratios while assessing the financial performance.

The remainder of the paper is organized as follows: subsequent section provides the literature review; afterwards research methods including data collection, screening, and cleaning are explained. This is followed by results and discussions. In the end, the conclusions from the study and recommendations for further research are presented.

Literature review

Importance of financial ratios

Financial ratio analysis is used to evaluate the position of the company with respect to the industry and other companies to assess the company's performance over a period of time. It is also considered valuable to measure the performance of managers, departments, and projecting the future trends of companies' performance for related stakeholders (Ross et al. 2003; De et al. 2010; El-Kholy and Akal 2019). Over the years, the development of various financial ratios and its application by the researchers and analysts has increased multifold (Ali and Charbaji 1994). The process of selection of financial ratios has always been difficult and problematic (Edum-Fotwe et al. 1996) due to the high probability of information overlaps. In case, all the ratios were considered, there was a problem of redundancy. On the other hand, in case only entirely independent ratios were considered, it could lead to the omission of certain important information from the process. This will in turn result in insufficient information for determining the complete financial performance state of the company. Since, there is a large set of ratios available, the process of analyzing these ratios and comparing different companies and industries becomes a tedious task. Therefore, it is required to combine the important ratios into smaller numbers of significant factors in such a way that information is not lost, and further analysis can be carried out on the smaller number of factors to form the performance evaluation framework.

To address this problem of selection, factor analysis of financial ratios has been performed by various researchers. For example, Pinches et al. (1973) concluded that the factors representing the group of financial ratios obtained after factor analysis was found to be reasonably stable over time.

Factor analysis

Factor analysis reduces the data by eliminating the variables which render redundancy to the depicted information on account of the multicollinearity which is defined as the interrelationship between different variables. Moreover, factor analysis uses the interrelationships among many variables in terms of common underlying hypothetical factors with a minimum loss of information (Hair et al. 2010). An original dataset of variables are termed as observable explicit variables and the unobservable implicit variables (latent variables) are termed as 'factors' which are hypothetical in nature (Xia 2009).

Use of factor analysis in global context

Öcal et al. (2007) determined five significant financial indicators by applying factor analysis to the financial ratios of the Turkish construction companies for a period of five-years. These indicators were identified as liquidity; assets structure; capital structure and profitability; profit margin and growth; and activity efficiency. Balatbat et al. (2010) carried out a comprehensive assessment on a range of financial performance indicators over a 10-year period (1998–2007). They concluded that the performance of the public listed Australian construction companies was found to be comparable to that of the blue chip companies, except for the period of the introduction of goods and services tax (GST) in 2000. Hsu (2013) applied factor analysis followed by calculation of objective weight of decision attributes by entropy concept. The multi criteria decision making (MCDM) method of technique for order performance by similarity to ideal solution (TOPSIS) was then applied to evaluate the financial performance of the Taiwan's 50 listed opto-electronic companies. The financial performance rankings for these companies were compared before and after the global financial turmoil in order to demonstrate the insignificant effect of the turmoil on their performance. Chen et al. (2011) performed factor analysis on the financial indices of 13 listed Chinese petroleum companies in the year 2009 in order to evaluate their performance on the basis of identified financial analysis indicators. They identified four financial indicators, namely indicator of growth, indicator of profitability, indicator of business efficiency and indicator of solvency. The noteworthy point in their study was the use of factor scores to rank the companies. They classified the 13 companies in three different categories based on score of each factor and overall factor score.

Additionally, Chong et al. (2013) examined the distributional properties of the financial ratios for the Malaysian companies using factor analysis. Along with the general conclusion that it is not necessary to use many ratios for assessing financial performances, it also concludes that the financial ratios are not normally distributed in general and that normality of certain ratios may be improved by remedial actions. Delen et al. (2013) identified the underlying dimensions of the financial ratios using exploratory factor analysis (EFA) followed by the use of four popular decision tree algorithms, namely chi-squared automatic interaction detector (CHAID), quick, unbiased, efficient statistical tree (QUEST), classification and regression trees (C&RT) and C-5.0. The results showed that CHAID and C-5.0 delivered the best prediction accuracy. The results from the sensitivity analysis of the independent variables indicated that earnings before tax-to-equity ratio and net profit margin were the two most important variables. Erdogan (2013) applied factor analysis on the financial ratios of the 500 industrial enterprises in Turkey for 2010 in order to eliminate the redundancy and group them into factors. Their study provided support to the debt overhang theory which proposes that excessive corporate debt can lead firms to underinvest in profitable projects. Also, they were able to provide partial support to the textbook classification of financial ratios. However, one of the major limitations of their study was the lack of assessment of content validity, reliability, dimensionality, and validity before application of data reduction. However, Cinca et al. (2005) showed that the financial ratio patterns vary with respect to different countries due to various factors such as a change in the economic environment and so on. Therefore, the results from these studies may not be directly applicable to the context of Indian construction industry.

Use of factor analysis in Indian context

In the Indian context, there have been few researchers who have tried to identify the significant financial factors. For example, De et al. (2011) applied factor analysis on 44 financial ratios to reduce them to 25 significant variables, grouped in 8 categories for the Indian cement industry. They identified 8 important factors, namely profitability and return on investment, cash position, capital structure, asset and material management, short-term liquidity, long-term solvency, dividend policy and productivity of working capital. The crucial point in the methodology adopted by them was the application of multiple regression analysis between the factor scores and constituent variables to exclude the statistically insignificant variables. Javalagi and Bhushi (2014) also applied factor analysis for identifying the six financial factors, namely profitability, retained profits, inventory, financial leverage, working capital and cash to current liabilities, governing the financial performance of the Indian sugar industry. In addition to this, they discussed various approaches to investigate the productivity in terms of financial ratios such as clustering approach, fuzzy clustering approach, and system dynamics modelling.

In the context of Indian construction industry, Tripathi and Jha (2017) conducted a study to determine performance factors for the construction organizations in India. They conducted factor analysis on the 20 performance attributes of the construction firms identified based on the literature. A total of six performance factors were identified: profitability and asset management; satisfaction of key stakeholders; predictability of time and cost; environment, health, and safety (EHS); quality consciousness; and low staff turnover. However, this study focused on mostly non-financial parameters.

There is a dearth of studies on financial ratios aimed towards the identification of the significant financial performance factors in the context of developing economies like Indian construction industry which employs a huge population of the country. Furthermore, there is enough empirical evidence from the earlier studies that financial ratio patterns vary from industry to industry, for e.g., between retail and manufacturing firms (Gombola and Ketz 1983). Therefore, it is not advisable to apply the financial factors obtained by factor analysis done for some other industry to the Indian construction industry. Thus, a need was felt to identify financial performance factors to determine the financial health of the construction industry of emerging economies such as India.

Accordingly, the objective of this study is to identify significant financial ratios pertaining to the Indian construction industry and group them into a smaller number of factors which are termed as 'significant financial performance factors (SFPFs). These factors describe the financial performance of the construction companies. Pinches et al. (1973) applied factor analysis on 48 financial ratios for a sample of 221 industrial firms. Their work deduced seven groups of financial ratios: (1) return on investment; (2) capital intensiveness; (3) inventory intensiveness; (4) financial leverage; (5) receivables intensiveness; (6) short term liquidity; and (7) cash position. This grouping among the financial ratios was found to be relatively stable over last four decades. This finding was further corroborated for the 1961–1969 time period by Pinches et al. (1975). Since, the compositions of these factors representing groups of financial ratios is found to be reasonably stable over time, the identified factors from the data of last decade can be believed to be stable for the industry in coming years and accordingly steps can be planned to boost the construction industry in future. Hence, a healthy duration of the ten years' period of 2008–2017 was considered for this study. Moreover, these factors can be used to measure and predict the performance of companies and the industry in future as well.

Research methods

A mix method of research approach involving both quantitative and qualitative techniques have been adopted. Quantitative techniques involved data collection, factor analysis for dimension reduction and grouping of factors. Whereas qualitative techniques have been used to explain the factor loadings for different groups and identify specific names for each of the groups.

Step 1: Data collection, screening, and cleaning

The initial objective was to use a large and feature-rich dataset. After an exhaustive search of various resources such as Screener, Moneycontrol, Capitaline Database, Investing, and Market Mojo, finally the "Capitaline (2019) database" was selected. Capitaline (2019) database is a sister product of Capital Market, India's foremost investment fortnightly. Due to the specialized expertise in data collection, standardisation and presentation built up since 1985, Capitaline (2019) database has earned the highest level of respect and confidence in the financial information industry (Kirca et al. 2016). The Capitaline (2019) database provides financial data for more than 35,000 Indian listed and unlisted companies classified under more than 300 industries. It includes extensive financial data of companies for over ten years such as financial ratios, cash flow, consolidated financial data, segment data, forex data, etc. A stratified sampling technique was adopted and the list of companies pertaining to construction industry was prepared on the basis of scope, sub-sectors, age, enlistment at the national stock exchange and most importantly the availability of financial statements for last ten years. The construction industry consists of five sub-sectors as per classification done in the Capitaline (2019) database such as i) large civil/turnkey; ii) medium civil/turnkey iii) small civil/turnkey; iv) factories/offices/commercial; and v) housing.

Before analysis of the data, the first concern was the determination of ideal sample size and data collection. Around 5 to 10 participants per variable up to a total of 300 participants was recommended by Kass and Tinsley (1979) beyond which test parameters tend to stabilise regardless of the participant to variable ratio. Comrey and Lee (1992) recommend 100 as poor, 300 as good, and 1000 as excellent sample size (participants/data records). Hence, for this study, a total of 1000 data records were collected from 100 construction companies, each for a period of 10 years. Further, a set of 20 financial ratios were considered for the same as per the availability in the Capitaline (2019) database as shown in Table A1 (Appendix). So, a set of 1000 data records (100 companies for 10 years) was compiled for each of the 20 financial ratios. To select 100 companies, the authors selected top 20 companies (on the basis of turnover) from each of the five abovementioned sub-sectors. The aim was to bring it down to 100 Indian construction companies with a healthy mix from all the sub-sectors of the construction industry; so that a nearly true representation of the construction industry may be achieved in a wholesome manner. However, after pre-processing and data cleaning process, six companies were eliminated from the dataset because they had extreme outliers in their financial dataset. Thus, data from a total of 94 companies comprising of 940 usable cases for each of the 20 financial ratios were utilized for carrying out factor analysis.

Step 2: Factor analysis of financial ratios

Exploratory factor analysis (EFA) has been carried out to identify the significant factors influencing the financial condition of the companies in order to take corrective and preventive steps for ensuring a better performance in the future. Since, there was a large set of ratios available, it became a tedious task to analyze these ratios and compare different companies and industries. Therefore, EFA was adopted as a quantitative technique which results into smaller number of significant factors by combining the important ratios in such a way that no information is lost, and further analysis can be carried out with ease (Hair et al. 2010).

SPSS software version 21, which stands for statistical package for social sciences, was used to analyze the data in this study. This tool has been developed by IBM which facilitates the application of factor analysis along with various other functions. The EFA, which is carried out using principal component analysis (PCA) and varimax rotation, is explained in detail along with the observations in the subsequent subsections.

Formation of initial correlation matrix

After arranging the dataset into the required format of independent variables horizontally and response variables vertically, the dimensional reduction was performed. It generates an inter-correlation matrix of the order of '20×20' where 20 equals the number of independent variables. The matrix basically depicts the coefficients of correlation of each of the variables with respect to all others including itself.

Check for data adequacy

To carry out factor analysis, it is necessary that the correlation matrix must be positive definite matrix which means that the eigen values and determinant of the matrix need to be positive in very basic terms. In this study, initially the correlation matrix was found to be non-positive definite when all the 20 financial ratios were considered. Therefore, the following possibilities were explored to address this issue:i) Since the sample size selected was 940 per independent variable which belongs to the excellent category as per previous recommendations, so there was no need to collect more data.ii) Highly correlated ratios were removed one by one empirically from the generated correlation matrix to remove redundancy till it was positive definite. A total of five ratios were removed: (i) PBIDTM – profit before interest, depreciation and taxes margin, (ii) PBITM – profit before interest and tax margin, (iii) PBDTM - profit before depreciation and tax margin, (iv) APATM - adjusted profit after tax margin, and (v) RONW – return on net worth.

After removing these five variables, KMO and BTS were conducted to check the sample adequacy. The results are presented in Table 1.

KMO value > 0.5 and Chi-square alpha >125 (at 1% significance level) indicate that the data sample is adequate for carrying out factor analysis (Öcal et al. 2007). Since these two values were found greater than the minimum required values, the collected data can be considered adequate for the analysis. Also, the significance value < 0.05 indicates sufficient correlation in the data for carrying out grouping.

Communality

The proportion of common variance present in a variable is known as the communality. As per Hair et al. (2006) variables

Table 1. KMO and Bartlett's test results.

Test parameter		Values obtained
KMO sampling adequacy measure		0.54
Bartlett's test of sphericity	Approx. Chi-square	6495.54
	Degree of freedom	105
	Significance value	0.000

with a communality greater than 0.5 are deemed to be very good for explaining common variance. The threshold value of communality is 0.3 (Basu and Jha 2016) below which the variables must be eliminated, which is further corroborated by their absence in the rotated component matrix under any of the factors.

In this study, most of the communality values are above 0.5 which signifies that the variables selected are reliable. One of the variables named "sales/net assets ratio" had a communality of 0.453, which also belonged to the acceptable range of 0.3-0.5. However, three variables showed communality less than 0.3, and therefore, were eliminated from the analysis. These were – debtors' turnover ratio; profit after tax to the profit before interest, tax and depreciation; and net fix assets/fix worth. After elimination of these three variables and five variables through correlation matrix (as explained in Check for data adequacy subsection), only 12 variables were left for further analysis. The average communality represented by the 12 variables comes out to be 0.77 which is greater than 0.60 justifying the use of Kaiser's criterion for extraction.

Factor extraction and rotation

This study utilizes principal component method of extraction with varimax rotation. This method maximizes the variance of the squared loading for each factor which produces a clear factor loading (Tripathi and Jha 2018). The principal component analysis is applied to determine the linear components of a set of variables within the data set (the eigen vectors). The Table 2 gives percentage of variance for before and after varimax rotation for 12factors which cumulatively explain 100% variance as shown by their initial eigen values.

The cumulative percentage of variance explained by these five factors was found to be 77.00%. This indicates that a significant amount of common variance shared by the 12 variables can be accounted by these five factors alone. Hence, these five factors were deemed "significant" in this study. Here, the most probable selection of type of rotation should be varimax because it is deemed to be a common approach that simplifies the interpretation of factors especially when extracted factors are expected to be independent as in the present case (Field 2009). Hence, varimax method, which is the most commonly used one, has been selected (Öcal et al. 2007) in order to simplify the interpretation. Maximum iterations for convergence was put to 250. Application of the Kaiser's criterion of extracting the factors with eigen value greater than one yielded five factors. The redistributed variances may be observed in Table 3.

Final component matrix

Component matrix refers to the matrix which consists of the output of factor loadings for each variable onto each factor. The factor loadings represent the degree to which the variables explain the respective components. The coefficients smaller than 0.4 were suppressed as factor loadings less than 0.4 are generally deemed to be insignificant for that particular factor.

Table 2. Total variance explanation without rotation.

	Initial Eigen Values		
Component	Total	% of Variance	Cumulative %
1	2.864	23.865	23.865
2	2.237	18.645	42.510
3	1.849	15.408	57.918
4	1.197	9.973	67.891
5	1.093	9.111	77.002
6	0.812	6.769	83.771
7	0.764	6.367	90.138
8	0.624	5.203	95.340
9	0.273	2.277	97.617
10	0.154	1.281	98.898
11	0.082	0.683	99.581
12	0.050	0.419	100.000

Table 3. Total variance explanation after rotation.

Component	Total	% of Variance	Cumulative %
1	2.764	23.036	23.036
2	2.123	17.692	40.728
3	1.917	15.974	56.701
4	1.237	10.312	67.013
5	1.199	9.989	77.002

Subsequently, the resultant component matrix combined with the percentage variance explanation by the five factors as depicted in Table 3, is represented in Figure 1

Results and discussions

The percentage of variance explained by each component represents its relative importance. (Petroni and Braglia 2000). Hence, it may be interpreted that component 1 i.e., Investor return factor which has variance explanation of 23.04% is relatively more important than Business efficiency factor (17.69%) and Operations management factor (15.97) and likewise. The factors extracted have been named using qualitative techniques depending upon the nature and scope of the variables loaded under each factor and are explained in the subsequent subsections.

Investor return factor

Factor 1, which has the strongest variance explanation at 23.04%, includes four ratios having strong factor loadings. It includes return on equity, return on capital employed, PBIDT/net assets, and sales/net assets. Return on equity (factor loading – 0.91) was calculated by dividing the net profit after tax by total shareholder's equity. It gives the amount of profit earned by the company with the investment by the shareholders. It reflects the effectiveness of the company at turning the investment put into the business for greater gains aimed at the growth of the company. Return on capital employed (factor loading – 0.84) is depicted by the ratio of net profit after tax to total paid in capital which actually measures the efficiency of the company while garnering returns from the invested capital (Kabajeh et al. 2012). PBDIT/net assets ratio (factor loading – 0.84) depicts the net profit before depreciation, interests, and taxes with respect to the net assets possessed by the company. This ratio helps the organization to gain a deeper insight into the relationship between its resources and its income. Sales to net assets ratio (factor loading-0.65) is represented by the ratio of the gross sales (after subtracting the sales allowances and deductions) to the aggregate book

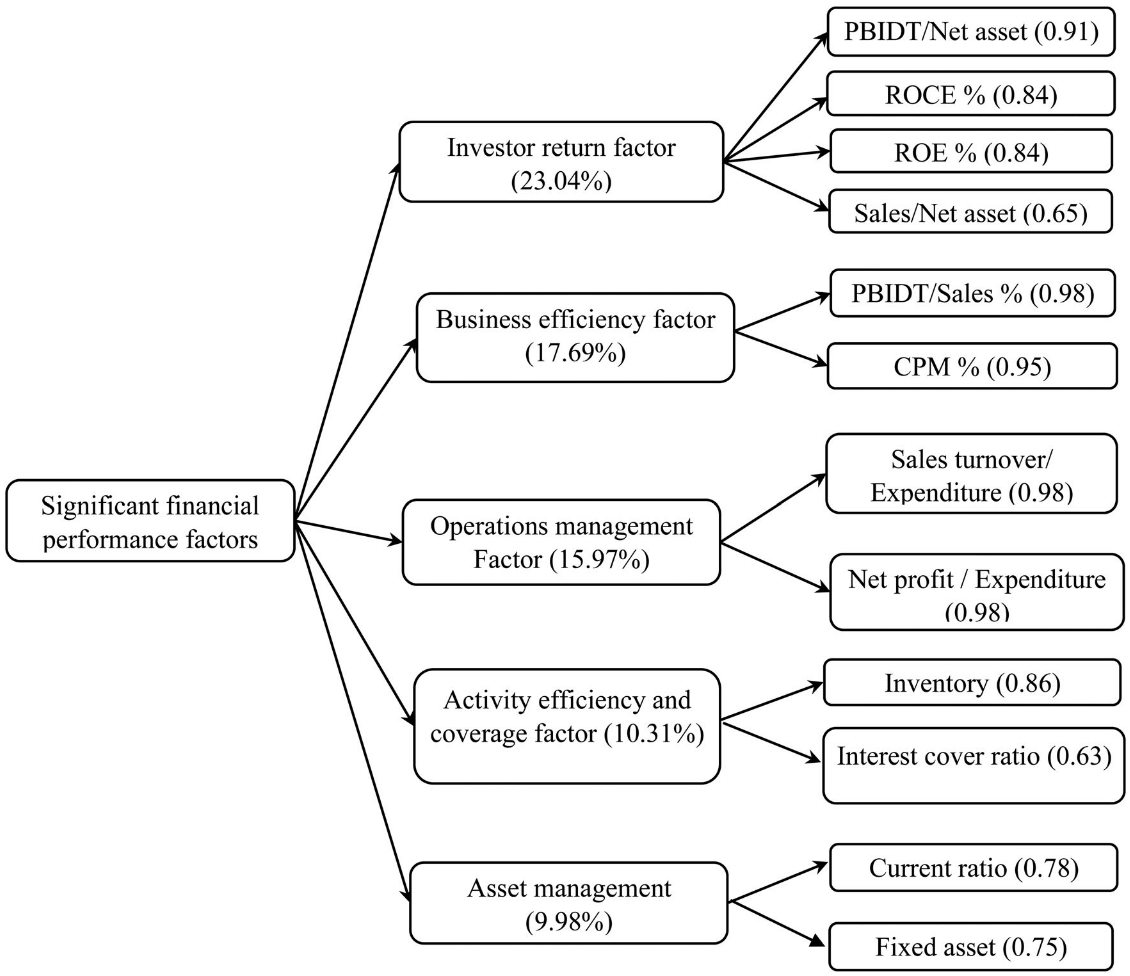

Figure 1. Significant financial performance factors derived from factor analysis.

value of all assets. It primarily measures the firm's capacity to generate sales with respect to the net assets.

These four ratios provide important information about the returns received by the stakeholders for their investments. Accordingly, the first group can be termed as the 'investor return factor (IRF)'. This factor can help the company in assessing its profit earning capacity for the investments employed in the business. Thus, accordingly, it can plan its investments in future. On further analysis of the constituent ratios, the stakeholders can decide whether it should employ its own capital or raise it through equity in future.

Business efficiency factor

Factor 2 explains 17.69% of the common variance of the data. It includes the ratios of cash profit margin (CPM) and PBIDT/sales. CPM (factor loading- 0.95) is depicted by the profit earned by the company (without excluding depreciation) in return for its sales. CPM is given by the ratio of the summation of adjusted net profit and depreciation by sales.

PBIDT/sales (factor loading- 0.98) depicts the profit earned by the company before the deduction of depreciation, interests, and taxes in return for its sales. It reflects the amount earned by the company after investing the operating expenses. Thus, a high value of this ratio indicates better earnings through efficient business processes.

These two ratios together reflect the business efficiency. Thus this factor can be termed as the 'business efficiency factor (BEF)'. This factor, with respect to construction firms, represents the profit earning capacity of the firm with respect to the total works it undertakes, i.e., sales. Thus, a higher value for this factor represents that the company is able to generate higher profits from the projects it undertakes, i.e., company is smart in the selection and efficient in the execution of the projects.

Operations management factor

Factor 3 possesses the variance explanation percentage of 15.97% and it includes the ratios of sales per unit expenditure and net profit per unit expenditure with each having factor loadings of 0.98.

Sales per unit expenditure represents the ratio of sales turnover per unit net expenditure. Sales turnover is defined as the total revenue generated through cash sales and credit sales by the company in one particular financial year (Felder et al. 1996). However, this revenue is generally restricted to operations and other gains such as interest income, sale of fixed assets, etc. are excluded. The expenditure accounts for expenses such as raw materials, power, and fuel cost, employee cost, other manufacturing expenses, selling and administrative expenses and miscellaneous expenses excluding the capitalised pre-operative expenses. Net profit per unit expenditure ratio accounts for the reported net profit after depreciation, interests, and taxes with respect to the total expenditure as discussed above (Beaver 1966).

These ratios together measure how efficiently the company is able to utilize its operational expenses for increasing its sales and profits. Thus, this group can be termed as 'operations management factor (OMF)'. A higher value for this factor represents that the company is efficiently utilizing its annual operating expenses for generating higher profits and sales.

Activity efficiency and risk coverage factor

Factor 4 explains 10.31% of the common variance of the data and includes the inventory turnover ratio and the interest coverage ratio. Inventory accounts for all goods a company possesses in its stock which includes raw materials, work-in-progress materials, and finished goods for sale. With respect to infrastructure/construction firms, inventory turnover ratio (factor loading − 0.86) gives an account of the efficiency with which the company is able to utilize its inventory for carrying out its operations and generating sales. It is calculated by dividing the total sales of a firm by average inventory investment during the period. Thus, inventory turnover ratio represents the activity efficiency of a firm.

Interest coverage ratio (factor loading- 0.63) is useful in determining the ease with which company pays interest expenses on its outstanding debt through its earnings. This ratio is calculated by dividing the company's earnings before interests and taxes by the company's interest expenses for the same period (Banerjee et al. 2009). In general, if the interest coverage ratio for a company is low, then the ability of the company to meet its liability of paying the interest expenses becomes questionable. In such a scenario, the company may not get many investors as its risk of default is perceived to be too high. Thus, interest coverage ratio represents the risk coverage capacity of the company (Dothan 2006 and Ji 2019). This factor can be termed as the 'activity efficiency and risk coverage factor (AERCF)'. A higher score on this factor represents that the company is efficient in utilizing its inventory for generating sales and at the same time it is generating enough profit to cover its interest expenses on the debt taken to carry out the business and effectively manage the risk of default. If a company is planning to take a loan to increase its inventory, this factor can be used to assess if the company is capable of generating higher sales through its increased inventory, and at the same time make sufficient profits to cover the interest expenses. Thus, if the company has a lower value on this factor, it should avoid taking further loans.

Asset management factor

Factor 5 explains 9.99% of common variance which is the least among all the five factors. It includes fixed assets turnover ratio and current ratio. Fixed assets turnover ratio (factor loading- 0.78) is calculated by dividing the net sales by fixed assets. It is used as an indicator of the asset utilization. It specifically measures the quantum of net sales generated by the company in return for its fixed-assets investments, namely property, plant, equipment, etc. A higher fixed assets turnover ratio indicates improved efficiency in managing assets, however, the significance of this ratio is dependent on the nature of the company.

The current ratio (factor loading- 0.75) is a liquidity ratio that measures a company's ability to pay short-term and long-term obligations such as debt, accounts payable, etc. It is calculated by dividing the current assets by current liabilities (Johnson and Mitton 2003). The current assets include both the liquid and illiquid total current assets of the company (Chen et al. 2015). Thus, higher the current ratio, more are the chances of the obligations to be paid by the company successfully.

This factor constitutes of ratios that relate to the assets of a company that is companies' efficiency in generating sales from its fixed assets (fixed asset turnover) (Dash and Ravipati 2009) and its ability to cover its liabilities through its current assets (current ratio) (Johnson and Mitton 2003; Chen et al. 2015). Thus, this factor can be termed as the 'asset management factor (AMF)'. A higher value for this factor represents that company is efficiently utilizing its fixed assets and at the same time has enough current assets to cover its liabilities.

Conclusions

The growth and development of the construction industry are of paramount importance for a developing economy like India, where it employs a huge chunk of the population and directly impacts the functioning of so many industries in order to support the economy. Hence, the government and related stakeholders must consider the significant financial performance factors (SFPFs) to undertake required actions for improving its state. Owing to the multi-dimensional nature of financial ratios, they are not only applied for finding the financial performance of the company with respect to time but also for making comparisons between various companies belonging to same or different sectors, which more often than not results in the identification of problematic areas which seek improvement.

Although, there is a good amount of literature available for different industries in various countries, there is a lack of studies on financial ratios which try to identify the significant financial performance factors in the context of Indian construction industry which employs a huge population. Different economic factors cause this significance to vary from one industry to other and also from one country to other due to various economic factors (Gombola and Ketz 1983; Cinca et al. 2005). Therefore, significant financial factors obtained by factor analysis done for some other industry and/or country will not be applicable to the Indian construction industry. This study aims to abridge this research gap by identifying the significant financial performance factors of the Indian construction companies.

This study aims to identify the SFPFs which can assess the financial performance of the Indian construction industry. These factors may be used by the managerial staff within the company, company's investors, shareholders, business analysts and government authorities to assess and compare the financial performance of various companies. In this study, factor analysis approach has been applied to the financial ratios of 100 Indian construction companies for the last 10 years (from 2008 to 2017) for finding the key factors which govern the financial performance of the Indian construction industry. After undergoing due processes of data reduction and grouping using factor analysis, five factors were identified. Based on the properties of the constituent ratios composing the factors, they were identified as investor return factor, business efficiency factor, operations management factor, activity efficiency and risk coverage factor, and asset management factor. These factors are capable of providing important relevant information about the financial performance of the company and thus helps the company and related stakeholders in planning its strategies and operations using these identified SFPFs.

Future work, contributions and recommendations

The next study, based on this work, will involve the development of financial performance evaluation framework (FPEF) by appropriate combination of all the SFPFs identified in this work. The framework will be applied to evaluate the financial performance of the Indian construction companies. It will involve the application of multi criteria decision making (MCDM) methods such as entropy and simple additive weighing (SAW) to find individual financial performance score (IFPS) of the companies for each of the ten years (2008–17) Further, the IFPS for ten years will be considered to find the net financial performance score (NFPS). All the 94 companies will be ranked based on NFPS. Thereafter, performance grade (PG) will be developed, which is nothing but the percentile belonging to each of the companies in order to indicate its relative position in the construction industry. Furthermore, generalised information regarding current financial state of each company and recommendations for improvement will be provided. Also, a financial performance equation will be developed to implement the FPEF to any particular company. The implementation of the framework will be illustrated through a case study to determine the relative position of any company with respect to the Indian construction industry and recommendations for improvement. This can provide a scientific tool for the government and related stakeholders to assess companies' financial performance and their relative position in the industry. It can in turn help in planning necessary steps required for the growth of a company and consequently the growth of the Indian construction industry in the forthcoming years

Further analysis may be done on the basis of classification of companies such as public or private; infrastructure or residential or commercial etc. Specific recommendations may be given to the companies for improvement in the financial performance according to their ranking scales which will help the government authorities and investors to set their priorities.

This information may be used to discover the financial trends of (i) the company with respect to time (ii) the company with respect to other companies (iii) the construction industry with respect to time, and (iv) company with respect to the construction industry. These financial trends may be used for forecasting future trends and may become the basis for investing in a company with respect to another. It may also be used by the concerned stakeholders of the Indian construction industry

Due to the lack of research in this area, especially in the Indian context, this research has the potential to be the point of reference for further studies and business applications. Related research may also be taken up towards the failure modelling of the companies by determining the zone of discrimination by applying various models such as Z-score bankruptcy model. This may lead towards the development of a systematic alert system in case of upcoming crisis for the Indian construction companies which will enable the concerned stakeholders to foresee the probability of failure of the firm and undertake preventive action for improvement. India, classified as a lower-middle income developing country, as per the World Bank and home to about 18% of the world's population, may be deemed as a good representative of developing countries. Thus, the five factors identified here may assist in providing a good point of reference for the financial analysis of construction industries, especially in developing countries.

However, in this study, only those 20 financial ratios have been taken into account for which data was available. Further, only those companies were selected for analysis for whom the financial data pertaining to the last 10 years was available. These may be deemed as the limitations of this study. A more exhaustive financial ratio analysis may be performed by taking more financial ratios and more companies into account provided the required data is available.

Disclosure statement

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Appendix

Table A1. Financial ratios considered in the study with their formulae and description [Capitaline (2019)].

S. No.	Financial ratios	Formulae	Description
1	Fixed assets turnover ratio	$\frac{\text{Netsales}}{\text{Netproperty, plantandequipment}}$	It is used as an indicator of the asset utilization as it measures a company's effectiveness in generating sales from investments related to the company.
2	APATM (Adjusted profit after tax margin in %)	$\frac{\text{Adjusted net profit}}{\text{Net sales}} \times 100$	It indicates the effectiveness of the company in controlling its costs. A higher value of this ratio may be interpreted as high efficiency of the company in providing more value in the form of profits to the shareholders.
3	ROCE (Return on capital employed in %)	$\frac{\text{Earnings before interest and tax (EBIT)}}{\text{Capital employed}}$	It is a comprehensive profitability indicator because it measures the ability of the management to generate earnings from the total pool of capital possessed by the company.
4	PBIDT/Net Assets (Profit before interest, depreciation, and taxes with respect to net assets)	$\frac{\text{Net profit before interest,depreciation and taxes}}{\text{Total assets} - \text{total liabilities}}$	It indicates the effectiveness of the company in utilizing its assets to generate profit before payment of contractual obligations such as interests, depreciation and taxes.
5	Net fixed assets/Net worth	$\frac{\text{Total fixed assets} - \text{accumulated depreciation}}{\text{Total assets} - \text{total liabilities}}$	It is a ratio for determining the solvency of the company. It shows the extent to which the company funds are frozen in the form of fixed assets, such as property, plant and equipment. It provides the realistic idea of the extent of funds available for the company's operations, which is known as working capital.
6	ROE (Return on equity)	$\frac{\text{Net income}}{\text{Shareholders' equity}}$	It highlights the amount of profit generated by the company with the money invested by its shareholders.
7	PBDTM (Profit before depreciation and taxes margin in %)	$\frac{\text{Gross profit before depreciation and taxes}}{\text{Sales}} \times 100$	It refers to a ratio which determines profit before depreciation and taxes margin expressed in percentage. This ratio indicates the percentage of company's earnings remaining after operating expenses.
8	Sales turnover/Expenditure	$\frac{\text{Total revenuefromcashandcreditsales}}{\left(\text{Total expenditure excluding capitalised pre} - \text{operative expenses}\right)}$	Sales turnover is computed by calculating the total amount of revenue generated including both the cash sales and credit sales by the company during the financial year under consideration.
9	PAT/PBIDT (Profit after tax with respect to profit before interest, tax, and depreciation expressed in percentage)	$\frac{\text{Profit after tax}}{\text{Profit before interest, depreciation and taxes}}$	It represents the effect of taxation on the earning of the company. This ratio plays a significant role in deciding the investment location during the setting up of the business.
10	Debtors turnover ratio	$\frac{\text{Netcreditsales}}{\text{Averageaccountrecievable}}$	It indicates the velocity of debt collection of a firm. It is also known as accounts receivable turnover ratio. It basically measures the firm's effectiveness in extending credit and in collecting debts on that credit.
11	Sales/Net assets	$\frac{\left(\text{Gross sales after subtracting the sales allowances and deductions}\right)}{\text{Aggregatebookvalueofalltheassets}}$	It is generally known as the asset turnover ratio. It measures the total value of a company's sales with respect to the value of its assets. It indicates the efficiency of deployment of assets by the company in generating revenue.
12	PBITM (Profit before interest and tax margin in %)	$\frac{\left(\text{Adjusted gross profit} + \text{interest} - \text{depreciation}\right)}{\text{Sales}} \times 100$	It refers to a ratio which determines profit before interest and tax margin expressed in percentage.
13	Net Profit/ Expenditure	$\frac{\text{Netprofit afterinterests, depreciationandtaxes}}{\left(\text{Total expenditure excluding capitalised pre} - \text{operative expenses}\right)}$	After deducting depreciation, interests, and taxes, the net profit with respect to the total expenditure is known as Net profit/Expenditure ratio.
14	PBIDT/ Sales (Profit before interest, depreciation, and taxes with respect to sales in %)	$\frac{\text{Earnings before interests and taxes}}{\text{Netrevenue} - \text{Earned}} \times 100$	It is used to assess profitability by comparing revenue with operating income before interest, taxes, and depreciation.
15	Inventory turnover ratio	$\frac{\text{Costofgoodssold}}{\text{Averageinventory}}$	It is a measure of the number of times inventory is sold or used in one particular year.
16	Current ratio	$\frac{\text{Currentassets}}{\text{Currentliabilities}}$	The current ratio is a liquidity ratio that measures whether a firm has enough resources to meet its short-term obligations.
17	CPM (Cash profit margin expressed in %)	$\frac{\text{Adjusted net profit} + \text{depreciation}}{\text{Sales}}$	It is use to determine operation performance by calculating earnings before interest, tax, depreciation and amortization.
18	RONW (Return on net worth in %)	$\frac{\text{Adjusted net profit} - \text{preference dividend}}{\text{Equity paid up} + \text{reserves}} \times 100$	It is a measure of a company's profitability. It shows how much profit a company generates with the money that the equity shareholders have invested.
19	PBIDTM (Profit before interest, depreciation and taxes margin in %)	$\frac{\text{Adjusted gross profit} + \text{interest}}{\text{Sales}} \times 100$	It refers to a ratio which determines profit before interest, depreciation and taxes margin expressed in percentage.
20	Interest coverage ratio	$\frac{\text{Earning before interest and taxes}}{\text{Interest expenses}}$	It is useful to determine how easily a company can pay their interest expenses on outstanding debt.

Table A2. Initial correlation matrix.

Correlation	Current Ratio	Fixed Assets	Inventory	Debtors	Interest Cover Ratio	PBIDTM (%)	PBITM (%)	PBDTM (%)	CPM (%)	APATM (%)	ROCE (%)	RONW (%)	PBIDT/ Sales(%)	Sales/Net Assets	PBDIT/ Net Assets	PAT/ PBIDT(%)	Net Assets/ Net Worth	ROE(%)	Net profit/ Expenditure	Sales Turnover/ Expenditure
Current Ratio	1.000	.186	-.034	-.031	-.007	.033	.019	.026	.026	.017	-.116	-.027	.033	-.088	-.111	.023	.134	-.027	.023	-.005
Fixed Assets	.186	1.000	.004	.017	.043	.016	.021	.023	.023	.027	.136	.156	.012	.116	.077	.021	-.039	.156	-.003	-.007
Inventory	-.034	.004	1.000	-.008	.249	.012	.013	.013	.013	.013	.151	.107	.010	.050	.142	.003	-.033	.107	.023	.041
Debtors	-.031	.017	-.008	1.000	-.006	.007	.008	.008	.008	.009	.045	.044	.005	.071	.052	.005	-.014	.044	-.003	-.002
Interest Cover Ratio	-.007	.043	.249	-.006	1.000	-.433	-.423	-.282	-.284	-.280	.203	.107	-.430	.019	.000	.009	-.040	.107	-.003	-.008
PBIDTM (%)	.033	.016	.012	.007	-.433	1.000	.992	.942	.942	.940	.060	.037	.991	.013	.183	-.003	-.007	.037	.112	.049
PBITM (%)	.019	.021	.013	.008	-.423	.992	1.000	.935	.933	.943	.071	.045	.982	.018	.190	.005	-.008	.045	.114	.053
PBDTM (%)	.026	.023	.013	.008	-.282	.942	.935	1.000	1.000	.997	.067	.047	.929	.024	.165	.004	-.008	.047	.118	.046
CPM (%)	.026	.023	.013	.008	-.284	.942	.933	1.000	1.000	.996	.065	.044	.929	.024	.163	.004	-.007	.044	.116	.044
APATM (%)	.017	.027	.013	.009	-.280	.940	.943	.997	.996	1.000	.072	.049	.927	.027	.169	.009	-.009	.049	.118	.047
ROCE (%)	-.116	.136	.151	.045	.203	.060	.071	.067	.065	.072	1.000	.737	.048	.281	.750	.039	-.140	.737	.007	.005
RONW (%)	-.027	.156	.107	.044	.107	.037	.045	.047	.044	.049	.737	1.000	.032	.334	.692	.026	-.104	1.000	.035	.030
PBIDT/Sales(%)	.033	.012	.010	.005	-.430	.991	.982	.929	.929	.927	.048	.032	1.000	.008	.186	-.002	-.010	.032	.142	.053
Sales/Net Assets	-.088	.116	.050	.071	.019	.013	.018	.024	.024	.027	.281	.334	.008	1.000	.577	.019	-.077	.334	-.032	-.035
PBDIT/Net Assets	-.111	.077	.142	.052	.000	.183	.190	.165	.163	.169	.750	.692	.186	.577	1.000	.037	-.128	.692	.047	.009
PAT/PBIDT(%)	.023	.021	.003	.005	.009	-.003	.005	.004	.004	.009	.039	.026	-.002	.019	.037	1.000	-.006	.026	.051	.006
Net Assets/Net Worth	.134	-.039	-.033	-.014	-.040	-.007	-.008	-.008	-.007	-.009	-.140	-.104	-.010	-.077	-.128	-.006	####	-.104	-.042	.024
ROE(%)	-.027	.156	.107	.044	.107	.037	.045	.047	.044	.049	.737	1.000	.032	.334	.692	.026	-.104	1.000	.035	.030
Net profit/Expenditure	.023	-.003	.023	-.003	-.003	.112	.114	.118	.116	.118	.007	.035	.142	-.032	.047	.051	-.042	.035	1.000	.913
Sales Turnover/Expenditure	-.005	-.007	.041	-.002	-.008	.049	.053	.046	.044	.047	.005	.030	.053	-.035	.009	.006	.024	.030	.913	1.000