Optimization
Iranian Journal of Optimization
Volume 8, Issue 1, 2016, 29-36
Research Paper
Online version is available on: www.ijo.iaurasht.ac.ir

Islamic Azad University
Rasht Branch
E-ISSN:2008-5427

Evaluation of Performance of Indian Banks by Using CAMEL AND GRA Techniques

Tata Hari Krishna *

Department of Mechanical Engg, JNTU KAKinada,Engineering College, India

Received: 16 December 2015
Accepted: 12 March 2016

Abstract

In the paper an attempt was made to study the performance of Indian Banks with the help of CAMEL(C-Capital Adequacy, A- Asset Quality, M- Management Quality, E-Earnings, L-Liquidity i.e. CAMEL) rating system, over the period of five years from (2011 to 2015) and then evaluated out the efficiency of banks with the help of GRA (Grey Relation Analysis) technique there by gaining confidence from investors and ranking them accordingly. The paper studied the influence of the degree of every performance factors through grey relational analysis and there by ranked the performance of every bank. The result thus obtained is compared with that of the Ranks obtained by CAMEL method. The research finding suggests that some banks are in advantage situation and thereby hinting at the possibility of further improvisation. Banks show marked consistency in their efficiency level during the period under study.

Keywords:
CAMEL rating
GRA
METHOD- PERFORMANCE
oF Indian banks

***Correspondence E-mail**: thkvrsec@gmail.com

INTRODUCTION

Banking Sector is considered a main driving force for industries in a particular economy, which tries to absorb shocks of varying magnitude in different time horizon. The Indian banking system has witnessed a very long history where the Indian Central Bank, The Reserve Bank of India (RBI) came into operation from 1935 but only after independence RBI was given broad regulatory authority over commercial banks in India. Real development in Indian economy started only after nationalization since private banks was not lending much who need the most as many banks failed in different countries leading varying degree of crisis leading to the strangling of economic growth for this reason CAMEL rating system serves as a barometer to gauge the financial and operational soundness of banks to mitigate such crisis in near future. In performance evaluation of banking institutions, CAMEL rating is much popular among regulators due to its effectiveness in different countries including India. But this method could not import the weights to performance dimensions/enablers to evaluate the overall performance of Banks. In lieu of this, performance of Indian public sector banks are evaluated and analyzed through TOPSIS, Gray Relation Analysis (GRA) and hybrid method of GRA-TOPSIS methods. The relative weights of performance dimensions and their enablers obtained in this paper are considered to evaluate the performance of twenty Indian public sector banks through the methods discus sued below. Performance evaluation of banking institutions is a scientific decision making process can be recognized by a) identifying the criteria/sub-criteria b) finding the relative weights of the criteria/sub-criteria b) gathering the qualitative or quantitative data c) making evaluation using appropriate scientific methods, and d) analyzing the alternatives which will be a base to objective decisions by the decision makers.

Literature review

Grey relation analysis method was firstly presented by Deng (Deng, 1989; 2003), and it was well applied in multiple attribute decision making (Wei and Wei, 2008; Men and Ji, 2008; Wei and Lin, 2008). The Grey relation analysis method was extended to deal with multiple attribute decision making problems which attribute value is respectively interval number, triangle fuzzy number, linguistic variable (Wei and Wei, 2008; Men and Ji, 2008; Wei and Lin, 2008). The grey analysis found number of applications for multi attribute decision making applications (Babatunji Omoniwa, 2014; Ravendra Singh etal. 2012; Gui-Wu Wei, 2011; Ching-Liang Chang, 2003). Wang (1999) applied projection method in real number multiple attribute decision making. Projection method is implemented as multi attribute decision making approach in the literature (Zhou and Liu, 2007) Peng and Li, 2006; Xu, 2004). Grey relation projection method combined the advantages of grey relation method and projection method. Mishra, A. K., Harsha, G., Anand S. and Dhruva, N. R., (2012) measured the performance of 12 public & private sector banks over a period of twelve years for which CAMEL rating was used. In their study individual parameter of CAMEL were ranked for Indian Banks and final composite rank was computed taking average ranks of all five parameters of CAMEL and they have concluded that private banks are performing better than public sector banks for the period ranging from 2000 to 2011. Md. Anwarul Kabir and Suman Dey (2012) measured the performance of Selected Private, Commercial Banks in Bangladesh (EXIM & IFIC) using the CAMEL rating for the period of four years. Their finding revealed that in some parameter EXIM was better and in other parameters IFIC was better. Misra S. K., and Aspal, P. K., (2013) measured the financial soundness of State Bank Group (All seven State Banks) for the period of two years and used CAMEL rating approach. They concluded that tough in some parameters some State Bank were top performing in that particular year, but overall the overall performance of the State Bank group is same this may be because of the adoption of modern technology, banking reforms and recovery mechanism however they gave more emphasis on SBI to improve further. Trivedi. K. R.(2013), in his paper "A Camel Model Analysis of Scheduled Urban Co-operative Bank in Surat City–A case study of Surat People's Co-operative bank" had evaluated the financial performance of the Surat People Co-operative Bank using a CAMEL model. In his study ten years data were analyzed by calculating twenty eight ratios and fount out the liquidity portion was below satisfactory and needed to improve.

Camel approach

CAMEL analysis is originally developed by federal regulators in the USA in the early 1970's to appraise the performance of commercial banks. CAMEL model is basically a ratio based performance measurement system based on financial measures for measuring the performance of banks. It involves computation of various ratios such as capital adequacy, Asset quality, Management capability, Earning ability and Liquidity of the banks. Different banks use different ratios for each variable of CAMEL model so as to find out ranking of various banks. The RBI has instituted this mechanism for critical analysis of the balance sheet of banks by themselves and presentation of such analysis is used to provide the internal assessment of the health of banks. The analysis, which is made available to the RBI, forms a supplement to the system of off-site monitoring of banks. The prime objective of the CAMEL model of rating banking institutions is to catch up the comparative performance of various banks. CAMEL rating is a subjective model which indicates financial strength of the Banks and thus it is used for the explicit assessment of bank‘s ability to manage its performance. It follows the following procedural steps to evaluate the banks overall performance.In this method, each bank is assigned a uniform composite rating based on five elements, C-Capital Adequacy, A- Asset Quality, M- Management Quality, E-Earnings, L-Liquidity i.e. CAMEL. CAMEL rating is a subjective model which indicates financial strength of banks and thus it is used for the explicit assessment of bank‘s ability to manage its performance.

The method follows the following procedural steps to evaluate the banks overall performance.

1. Calculating related ratios reflecting performance in terms of parameters like Capital Adequacy, Asset Quality, Management, Earnings and Liquidity.

2. Calculate the average value of each sub parameters in all banks and rank it from largest to smallest.

3. Calculate the group average of all parameters for all banks and rank it from smallest to largest, Smaller the rank higher the value.

4. In order to measure the overall CAMEL ranking sum all group averages of all parameters, calculate the average and rank it from smallest to largest.

In performance evaluation of banking institutions, CAMEL rating is much popular among regulators due to its effectiveness in different countries including India.

Grey relation analyaia

Grey relational analysis is a kind of method which enables determination of the relational degree of every factor in the system. The method can be used for systems that are incompletely described with relatively few data available, and for which standard statistical assumptions are not satisfied. Grey relational analysis quantifies all influences of various factors and their relation, which is called the whitening of factor relation it from smallest to largest. The methodology is explained in the following steps.

Step 1: Identification of performance evaluation dimensions and their enablers of banks.

In the present paper, five performance dimensions namely: Capital Adequacy, Asset Quality, Management Efficiency, Earning Quality and Liquidity with seventeen enablers arevconsidered to measure the performance of Indian public sector banks.

Step 2: Determination of relative weights of performance dimensions.

The relative weights of the performance dimensions are determined using conjoint analysis.

Step 3: Determination of relative weights of performance enablers.

The relative weights of the performance enablers under respective performance dimensions are determined using Analytic Hierarchy Process (AHP).

Step 4: Obtain the global weights of the performance enablers.

The global weights of the performance enablers determined by considering the the below data.

Step 5: Obtain the Data .

The data on the financial ratios of the banks may be obtained through annual reports, financial statements etc.

Step 6: Standardize the Data.

It is difficult to compare between the different kinds of factors because they exert a different influence. Therefore, the standardized transformation of these factors must be done. Three formulas can be used for this purpose.

$$x_i(j) = \frac{x_i(j) - \min x_i(j)}{\max x_i(j) - \min x_i(j)}$$

The above formula in is suitable for the benefit – type factor.

$$x_i(j) = \frac{\max x_i(j) - x_i(j)}{\max x_i(j) - \min x_i(j)} \quad Cost\ type$$

the above formula is suitable for defect – type factor.

$$x_i(k) = \frac{|x_i(k) - x_0(k)|}{\max x_i(k) - x_0(k)}$$

The standardized formula shown above in equation is suitable for the medium – type factor.

Step 7: Determine absolute differences

The absolute difference of the compared series and the referential series should be obtained by using the following equation

$$\Delta x_i(k) = |x_0(k) - x_i(k)|$$

Step 8: Find out maximum and minimum absolute differences

The maximum (Δmax) and the minimum (Δmin) difference should be found from The absolute difference of the compared series and the referential series.

Step 9: Determine grey relation coefficient

In Grey relational analysis, Grey relational coefficient ξ can be expressed as shown in the following equation

$$\xi_i(k) = \frac{\Delta\min + p\Delta\max}{\Delta x_i(k) + p\Delta\max}$$

The distinguishing coefficient p is between 0 and 1. Generally, the distinguishing coefficient p is set to 0.5.

Step 10: Determine grey relational degree

The relational degree is determined using the following equation.

$$r_i = \sum [w(j)\xi(j)]$$

w(k) - Weight of the k^{th} enabler

Step 11: Ranking of Banks.

Ranking is done on the basis of descending order of the relational degree values, i.e. the bank with the highest relational degree is assigned the topmost rank and the one with the lowest relational degree is given the lowermost rank.

In this Paper, the performance of public sector banks is evaluated through grey relation analysis GRA, method with a case study of twenty Indian public sector banks. The data on five performance dimensions for 20 banks is compiled from the financial reports for 2015 is presented below.

Similarly the financial data for the years 2011, 12, 13, 14, are taken (Table1).

Global weights obtained by Analytic Hierarchy Process (AHP). The methodology is explained below.

In this study the relative weights of enablers are obtained through AHP (Analytic Hierarchy Process) approach from the responses obtained from short structured interview with bank employees in terms of pair wise comparison matrices. The methodology is discussed in the following steps.

Step1: Hierarchical Decomposition of Decision Elements

Hierarchical decision making frame work is developed with performance dimensions and their enablers. The performance enablers validated in the confirmatory factor analysis CFA will be considered in decision making frame work.

Step 2: Obtain Pair wise comparison matrix

Pair-wise comparison matrix of enablers and performance dimensions is formed by discussions with employees of the public sector banks.

Step 3: Sum the values in each column of the pair-wise comparison matrix.

Step 4: Divide each element in a column by the sum of its respective column. The resultant matrix is termed the normalized pair-wise comparison matrix.

Step 5: Sum the elements in each row of the normalized pair-wise comparison matrix, and divide the sum by the *n* elements in the row. These final numbers can be adopted to estimate the relative priorities of the elements being compared. Priority vectors must be determined for all comparison matrices.

Step 6: Obtain Global Weights

Global weights of the enablers are obtained by multiplying the relative weight of the enabler with the relative weight of the respective performance dimension.

The weights so obtained are useful to determine the grey relation coefficient of the banks.

Table1: Data on five performance dimensions for 20 banks

S. No	Banks	CA			AQ			MC			EQ				LI			
		Capital Adequacy Ratio	Advance to assets	Govt.Sec To Total Inv.	Net NPA to Net Advance	Net NPA to total assets	Total Inv to total assets	Business per employee	Profit per employee	Credit Deposit Ratio	Return on Assets	NIM to total assets	Operating profit to total asset	Interest income to total income	Liquid asset to total asset	Govt-Sec. to total asset	Liquid asset to total deposits	Liquid asset to demand deposits
1	Allahabad Bank	10.52	66.00	81.15	3.99	2.63	24.87	14.30	2.56	77.49	0.29	1.37	1.96	90.81	4.25	20.18	4.99	49.96
2	Andhra Bank	10.88	68.02	91.41	2.93	1.99	25.11	15.44	3.00	81.25	0.38	1.62	1.78	61.61	4.06	22.95	4.85	77.45
3	Bank of Baroda	13.33	59.87	79.22	1.89	1.13	17.11	18.89	6.88	69.32	0.49	0.32	1.39	90.71	3.15	13.55	3.64	42.59
4	Bank of India	11.42	64.98	87.72	3.36	2.18	19.36	20.69	7.00	75.58	0.27	0.37	1.21	91.12	4.39	16.98	5.11	126.52
5	Bank of Maharashtra	12.79	67.52	79.98	4.19	2.83	25.14	15.60	3.00	80.74	0.33	1.93	1.61	92.64	4.56	20.11	5.45	58.32
6	Canara Bank	10.98	60.23	86.37	2.65	1.59	26.52	14.35	5.00	69.65	0.55	0.41	1.27	90.58	4.01	22.91	4.64	110.71
7	Central Bank of India	11.89	60.42	78.99	3.61	2.18	30.61	11.38	1.53	73.75	0.21	0.89	1.14	93.31	4.52	24.17	5.52	106.91
8	Corporation Bank	11.8	64.19	76.71	3.08	2.83	28.06	19.14	3.25	27.77	0.28	0.92	1.34	92.95	4.49	21.52	5.09	77.89
9	IDBI Ltd	3.13	58.53	69.02	2.88	1.98	33.98	24.65	6.85	80.20	0.27	0.53	1.61	87.54	3.66	23.45	5.02	42.86
10	Indian Bank	13.24	65.27	84.12	2.50	1.68	23.80	14.43	4.95	74.38	0.54	1.30	1.56	92.08	4.30	11.93	4.91	98.04
11	Indian Overseas Bank	11.15	60.13	84.10	5.71	3.44	28.47	13.24	0.00	69.81	0.00	0.72	1.16	91.80	4.42	23.94	5.14	86.32
12	Oriental Bank of Commerce	12.28	63.02	75.70	3.32	2.09	29.69	17.43	2.46	71.20	0.23	0.98	1.83	90.39	4.42	22.48	4.99	79.35
13	Punjab National Bank	12.99	62.07	81.94	4.05	2.55	25.07	13.19	5.00	75.90	0.53	0.52	1.98	88.72	4.02	20.54	4.83	72.14
14	State Bank of Bikaner & Jaipur	11.69	67.98	91.84	2.54	1.73	21.96	11.00	6.00	82.56	0.84	3.29	2.06	90.67	7.61	20.17	9.24	185.96
15	State Bank of India	12.79	63.48	77.45	**2.12**	1.35	24.17	**10.64**	4.85	82.45	0.68	0.15	1.90	87.10	5.66	18.72	7.35	93.03
16	State Bank of Travancore	11.63	65.08	83.89	2.04	1.32	25.24	12.22	3.00	75.45	0.32	2.05	1.30	90.41	5.06	21.17	5.86	186.55
17	Syndicate Bank	10.92	66.87	89.73	1.90	1.27	22.87	15.39	5.55	79.38	0.58	0.79	1.32	91.11	3.95	20.52	4.69	69.43
18	UCO Bank	12.91	59.92	83.24	4.30	2.57	28.00	13.77	4.82	68.75	0.48	0.96	2.00	90.62	3.36	23.31	3.86	310.77
19	Union Bank of India	10.74	66.99	77.57	2.71	1.81	24.66	14.20	5.00	80.68	0.49	0.66	1.53	90.11	3.95	19.85	4.75	71.41
20	United Bank of India	11.42	54.27	75.15	6.11	3.32	37.88	11.53	15.98	61.35	0.21	1.80	1.97	85.53	4.37	28.47	5.34	65.02

Table 2: Global Weights of Performance Enablers

Performance Dimension	Performance Enabler	Global Weight
Capital Adequacy (CA)	Capital adequacy ratio	0.0684
	Advences to assets	0.0239
	Government Securities to total investments	0.0098
Asset Quality (AQ)	Net NPA to Net Advance	0.0931
	Net NPA to Total Assets	0.0646
	Total Investments to Total Assets	0.0357
Management Soundness (MS)	Business per employee	0.0944
	Profit per employee	0.0653
	Credit deposit ratio	0.0379
Earning Quality (EQ)	Return on assets	0.0919
	NIM to total assets	0.0648
	Operating Profit to total assets	0.0353
	Interest income to total income	0.0082
Liability (LI)	Liquid assets to total assets	0.0915
	Government Securities to total assets	0.0656
	Liquid assets to total deposits	0.0348
	Liquid assets to demand deposits	0.0081

Grey Relation Degree

Grey relation grade is calculated as per the methodology and the banks are ranked based on grey relation degree.

When banks ranked according to the grey relational grades, Bank of Baroda ranks first with its grade of 0.5484, followed by IDBI Bank and Andhra bank with the grades of 0.5429 and 0.5386, respectively. Last rank is obtained with bank of Maharashtra with a grey relation grade of 0.3472.

But till now, Due to radical changes in the banking sector in the recent years, the banks all around the world have improved their supervision quality and techniques. In evaluating the function of the banks, many of the developed countries are now following uniform financial rating system (CAMEL RATING). where CAMEL rating system does not consider the relative weights of the performance dimensions and their enablers while ranking of the banks. In this paper, five performance dimensions and seventeen enablers are con-

Table 3: Grey Relation Degree and Ranking

S.No	Bank name	Grey Relation Degree	Rank
1	Allahabad Bank	0.4108	12
2	Andhra Bank	0.5386	3
3	Bank of Baroda	0.5484	1
4	Bank of India	0.3908	17
5	Bank of Maharashtra	0.3472	20
6	Canara Bank	0.4734	7
7	Central Bank of India	0.3953	15
8	Corporation Bank	0.4945	5
9	IDBI Ltd	0.5429	2
10	Indian Bank	0.5100	4
11	Indian Overseas Bank	0.3926	16
12	Oriental Bank of Commerce	0.4224	10
13	Punjab National Bank	0.4406	8
14	State Bank of Bikaner & Jaipur	0.4303	9
15	State Bank of India	0.4749	6
16	State Bank of Travancore	0.4180	11
17	Syndicate Bank	0.4065	13
18	UCO Bank	0.3585	18
19	Union Bank of India	0.3971	14
20	United Bank of India	0.3496	19

Table 4: Year wise Ranking by Grey Relation Analysis

S.No	Bank name	Ranking by GRA					
		2011	2012	2013	2014	2015	Average
1	Allahabad Bank	12	8	19	18	18	17
2	Andhra Bank	3	4	9	15	7	8
3	Bank of Baroda	1	1	6	3	3	1
4	Bank of India	17	16	13	6	11	12
5	Bank of Maharashtra	20	12	4	10	10	15
6	Canara Bank	7	11	15	12	12	10
7	Central Bank of India	15	20	18	20	19	20
8	Corporation Bank	5	5	5	8	14	7
9	IDBI Ltd	2	7	1	2	8	4
10	Indian Bank	4	2	10	9	6	5
11	Indian Overseas Bank	16	14	17	17	20	18
12	Oriental Bank of Commerce	10	19	16	14	16	16
13	Punjab National Bank	8	9	8	11	15	9
14	State Bank of Bikaner & Jaipur	9	6	3	1	1	3
15	State Bank of India	6	3	7	7	2	2
16	State Bank of Travancore	11	13	11	16	5	11
17	Syndicate Bank	13	10	2	4	4	6
18	UCO Bank	18	17	12	5	17	14
19	Union Bank of India	14	15	14	13	9	13
20	United Bank of India	19	18	20	19	13	19

sidered to rank the banks through GRA, by considering the relative weights of the performance dimensions and their enablers. The methods are illustrated with a case study of twenty Indian public sector banks. Significant correlation of the methods in ranking the banks is observed. The proposed methods, illustrated in this paper can potentially be implemented to other service and manufacturing organizations to determine their performance. The study made in this paper is useful to the management to optimize the performance by improving the critical performance enablers.

Table 5: Ranking by CAMEL Approach

Bank name	2011	2012	2013	2014	2015	AVG	stdev	Rank
Allahabad Bank	16	13	19	20	14	16.4	3.04959	18
Andhra Bank	1	1	3	8	4	3.4	2.88097	3
Bank of Baroda	3	3	12	13	9	8	4.79583	5
Bank of India	12	12	9	4	7	8.8	3.42052	7
Bank of Maharashtra	20	15	5	6	8	10.8	6.45755	12
Canara Bank	7	11	16	9	11	10.8	3.34664	11
Central Bank of India	14	16	18	19	17	16.8	1.92354	19
Corporation Bank	15	9	7	10	10	10.2	2.9495	9
IDBI Ltd	4	7	11	11	18	10.2	5.2630	10
Indian Bank	9	6	4	3	2	4.8	2.77485	4
Indian Overseas Bank	13	5	13	17	20	13.6	5.639872	15
Oriental Bank of Commerce	11	19	14	15	16	15	2.9947	17
Punjab National Bank	8	18	10	16	12	12.8	4.14771	13
State Bank of Bikaner & Jaipur	2	2	2	2	1	1.8	0.4495	1
State Bank of India	17	8	8	7	6	9.2	4.68204	8
State Bank of Travancore	6	10	6	14	5	8.2	3.7736	6
Syndicate Bank	5	4	1	1	3	2.8	1.78382	2
UCO Bank	18	14	15	5	15	13.4	4.9295	14
Union Bank of India	10	17	17	12	13	13.8	3.1143	16
United Bank of India	19	20	20	18	19	19.2	0.83667	20

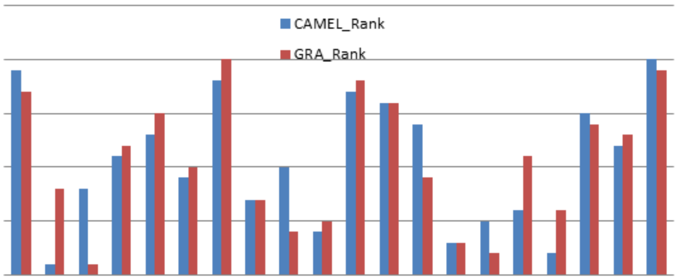

Fig.1. Comparison of CAMEL Rank and GRA rank

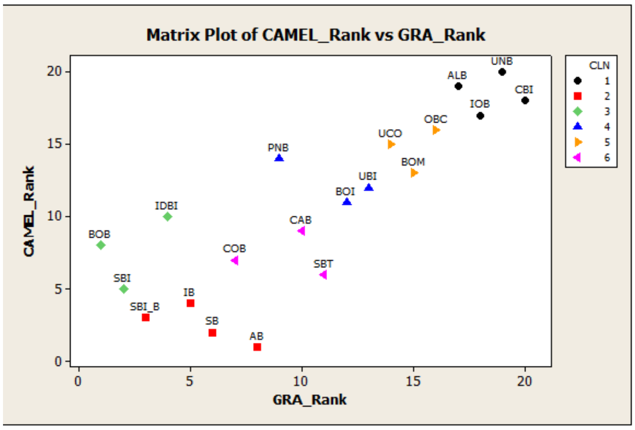

Fig.1. Matrix plot of CAMEL rank versus GRA Rank

Cluster analysis conducted and the banks are categorized into six clusters as shown in the following graph.

Cluster analysis clearly indicate that the banks under study are classified under six categories as per the ranks obtained by CAMEL and GRA Ranking.

CONCLUSIONS

In order to analysis the influence factors of service innovation performance in indian banks, this paper firstly set up an evaluation model of innovation performance by using Grey relation Analysis where the relative weights of performance dimensions and enablers are evaluated and then Secondly, evaluated GRA coefficients of the Financial years from 2011 to 2015, by collecting the relative data from annual reports of every bank, finally judged the influence degree of every performance factors through grey relational analysis theory and there by ranked the performance of every bank. The result thus obtained is compared with that of the Ranks obtained by CAMEL method. Thus the importance of financial indicators and their relative weight age is stressed and it is here by recommended that clear cut monitoring the performance is required periodically in the banking sector.

REFERENCES

Bryson, N., & Mobolurin, A. (1996).An action learning evaluation procedure form multiple criteria decision making problems. *European Journal of Operations Research,* 96(3), 379-386.

Deng, J.L.(1989). Introduction to Grey System. *Journal of Grey Systems.* UK, 1(1), 1-24.

Deng, J.L.(2003). The grey theoretical foundation. Wuhan: Hua zhong University of Science and Technology Press.

Hwang, C. L., & Yoon, K. (1981). Multiple Attribute Decision Making, vol. 186 of. *Lecture Notes in Economics and Mathematical Systems*.

Kabir, M.A., & Dey, S. (2012). Performance analysis through CAMEL rating: A comparative study of selected private commercial banks in Bangladesh. *Journal of Politics & Governance*, 1(2/3), 16-25.

Mishra, G., Harsha, S., Anand, &. Dhruva, N. R. (2012). Analyzing soundness in Indian banking: CAMEL approach. *Research Journal of Management Sciences*, 1(3), 9-14.

Misra, S.K., & Aspal, P.K. (2013). A camel model analysis of state bank group. *World Journal of Social Sciences,* 3(4), 36–55.

Omoniwa, B. (2014). A solution to multi criteria robot selection problems using grey relational analysis. *International Journal of Computer and Information Technology*, 3(2), 329-332.

Qing-li, DA., & Ze-shui, Xu. (2002). Single-objective optimization model in uncertain multi-attribute decision-making. *Journal of Systems Engineering*, 17(1),50-55.

Trivedi, K. R. (2013). A camel model analysis of scheduled urban co-operative bank in Surat City–A case study of Surat people‟s cooperative bank. *IOSR Journal of Business and Management,* 48-54.