International Journal of Research in Entrepreneurship & Business Studies
eISSN-2708-8006, Vol. 1, issue. 2, 2020, pp. 44-53
https://doi.org/10.47259/ijrebs.125

Performance Efficiency of Engineering Industries in India

Balamurugan Muthuraman
Asst. Professor, Administrative and Financial Sciences, Oman College of Management & Technology, Oman
Email: balamurugan.muthuraman@omancollege.edu.om

Citation: Muthuraman, B. (2020). Performance Efficiency of Engineering Industries in India. *International Journal of Research in Entrepreneurship & Business Studies*, 1(2), 44 - 53.
https://doi.org/10.47259/ijrebs.125

Received on 21st Aug. 2020
Revised on 4th Oct. 2020
Accepted on 11th Oct. 2020
Published on 11th Oct. 2020

Abstract

Purpose: To critically analyse the financial growth pattern and the overall performance efficiency of industrial machinery companies in India.

Design/methodology/approach: The data collected from the financial statement of the companies for 10 years from 2007-2008 to 2016-17 were analysed with the help of different accounting and statistical tools. Discriminant analysis has been adopted for analysing and interpreting the quantitative data was carried out using SPSS.

Findings: The study reveals that good performance efficiency of the engineering industry over the period 2007-2017, most Indian engineering industries exist with high net profit. The poor performance companies need of the hour to increase profit by reducing costs.

Practical implications: The study has interesting policy implications. It is recommended to encourage foreign banks' presence to enhance the competitive condition of the banking sector thus making sure the exit and entrance of banks in the industry to raise the competition. The pursuit of modernization, in fully hardening the resources of information technology should be relentless. It is a field that demands great attention and expertise.

Originality / Value: This research work is one of its first kind as no study was conducted before focusing on the performance perspectives of the engineering industries in India.

Keywords: Financial Performance, Engineering industries in India, Financial Statement Analysis, Modernization, Discriminate Analysis.

Introduction

The Indian economy has been flourishing with a myriad of industries since independence. The Indian industrial machinery presents itself as one of the most promising and employment generating sectors in India's economy. Increases in productivity through the adoption of more efficient and economic technology will be effective in merging economic and social development strategies. The engineering industry is the largest segment of the whole Indian industrial sector. The major end-user industries for heavy engineering goods are power, infrastructure, steel, cement, petrochemicals, oil and gas refineries, fertilizers, mining, railways, automobiles, textiles, and the like. Today, at the threshold of a global market, there exist many challenges to be faced by the Indian engineering industry. Since the beginning of this decade, dramatic political and economic changes have been taking place in India and the Indian industrial machinery has achieved impressive growth. The Indian industrial machinery is a vital segment of the Indian economy as it has enormous potential, for promoting high-grade skills, building entrepreneurship, and stimulating the development and introduction of state-of-the-art sophisticated technology.

Machinery is important for all industries because it boosts their productivity. Advances in technology will make industrial machinery more efficient and thus more desirable. The demand for industrial machinery is expected to remain strong and it is highly sensitive to cyclical swings in the economy resulting in fluctuations in the employment potential of the industrial machinery in the engineering industry.

The engineering industry is reckoned as one of the most dynamic sectors of the Indian economy. It accounts for nearly a third of the productive capital and value-added output in the organized sector. It is the largest provider of employment among industries. A survey conducted by the Confederation of Engineering Industries; India (CEI) shows that this industry provides jobs to 30.8 percent of all industry workers. Around 80 percent of foreign companies have ventured into India through the engineering industry and about 35 percent of the Indian collaborative ventures abroad are represented by engineering units.

Foreign exchange worth hundreds of crores received in the form of loans and aid has been given to major industrial undertakings of public and private sectors. A close association exists between industrial growth and general economic growth. Speedy industrialization can be achieved only if the basic industries are suitably planned and started.
Industrial machinery continues to evolve to adopt new technologies and techniques to lower costs and raise the productivity of its workforce. Growing pressure from domestic and foreign competition is increasingly forcing it to switch over to high technology production techniques.

The performance of the engineering industry is linked to the performance of the end-user industries for this sector. The user industries for engineering include power utilities, industrial majors (refining, automotive, and textiles), government (public investment), and retail consumers like pumps and motors. The engineering sector has been growing driven by the growth at the end-user industries and by the new projects being taken up in the power, railways, infrastructure development, and private investment fields, and the like.
India is preferred by global manufacturing companies as an outsourcing destination due to its lower labour cost and better designing capabilities. Indian engineering goods are gaining acceptance in overseas markets. Thus, engineering companies have a huge potential for direct exports and outsourcing.

Statement of the Problem
The engineering industry also called the engine of growth occupies a vital and significant position in the Indian economy. The engineering sector is the largest segment of the entire industrial sector of India. This large sector can be categorized into heavy engineering and light engineering segments, out of which the heavy engineering segment forms the majority of the engineering sector in India.
Multinational companies wishing to invest in India find it extremely hard to adapt to the different and existing Indian business systems. This is a key factor for the Indian companies be a collaboration with foreign MNCs. Disparities in policy-making across individual states place hurdles for the smooth flow of business nation-wide. The lack of a holistic national vision and guidelines has created a vacuum in the consistent development of industrial machinery in the engineering industry.

On a review of literature, the following research questions were raised:

1. What is the pattern of growth among the companies in industrial machinery in India?
2. What is the role of overall financial performance efficiency in industrial machinery in India?

Objectives of the Study
The objectives of the study were

- To critically analyse the financial growth pattern of industrial machinery in India.
- To critically analyse the overall performance efficiency of industrial machinery in India.

Table 1. Selected Industrial Machinery companies in India.

#	Company's NAME	Abbreviation
1	A C C Machinery Co. Ltd.	ACCMachinery
2	Adarsh Plant Protect Ltd.	APPL
3	Alfa Laval (India) Ltd.	ALL
4	Avery India Ltd.	AIL
5	Bemco Hydraulics Ltd.	BHL
6	Bharat Earth Movers Ltd.	BEML
7	Bharat Heavy Electricals Ltd.	BHEL
8	Brady & Morris Engg. Co. Ltd.	B&MEL

9	Cummins India Ltd.	CIL
10	Disa India Ltd.	DIL
11	Eimco Elecon (India) Ltd.	EEL
12	Elecon Engineering Co. Ltd.	EECL
13	Ema India Ltd.	EIL
14	Escorts Ltd.	EL
15	Flat Products Equipment (India) Ltd.	FPEL
16	G G Dandekar Machine Works Ltd.	GGDMWL
17	Gujarat Textronics Ltd.	GTL
18	Hercules Hoists Ltd.	HHL
19	Incon Engineers Ltd.	IEL
20	International Combustion (India) Ltd.	ICL
21	Kabra Extrusiontechnik Ltd.	KEL
22	Kirloskar Oil Engines Ltd.	KOEL
23	Kulkarni Power Tools Ltd.	KPTL
24	Lakshmi Automatic Loom Works Ltd.	LALWL
25	M P I L Corpn. Ltd.	MPIL
26	Manugraph India Ltd.	MIL
27	Millars India Ltd.	Millars
28	Mitsubishi Heavy Inds. India Precision Tools Ltd.	MHIIPT
29	Miven Machine Tools Ltd.	MMTL
30	Nesco Ltd.	NL
31	Paper Mill Plant & Machinery Mfrs. Ltd.	PMP&M
32	Praj Industries Ltd.	PIL
33	Punjab Tractors Ltd.	PTL
34	Revathi Equipment Ltd.	REL
35	Sandvik Asia Ltd.	SAL
36	Schlafhorst Engineering (India) Ltd.	SEL
37	Shilp Gravures Ltd.	SGL
38	Shivagrico Implements Ltd.	Shivagrico
39	Sirdar Carbonic Gas Co. Ltd.	SCGL
40	Stovec Industries Ltd.	SIL
41	Sulzer India Ltd.	Sulzer
42	Suzlon Energy Ltd.	Suzlon
43	Swaraj Engines Ltd.	Swaraj
44	T R F Ltd.	TRFL
45	Thermax Ltd.	Thermax
46	V S T Tillers Tractors Ltd.	VSTT
47	Vijoy Steel & General Mills Co. Ltd.	VS&GM
48	Walchandnagar Industries Ltd.	WIL
49	Wendt (India) Ltd.	WL
50	Windsor Machines Ltd.	WML

Review of Literature

Balakrishnan and Babu (2003) found that the annual average rate of growth in the nineties to have risen almost across the board at the two-digit level of the industry and the hefty rise in investment, without a corresponding increase in its efficiency. Baldwin and Gu (2006) revealed that a disproportionately large fraction of the contribution of plant turnover to productivity growth was due to multi-plant or foreign-controlled firms closing and opening new plants. The plants opened by multi-plant or foreign-controlled firms were typically much more productive than those opened by single-plant or domestic-controlled firms. Kumari (2006) revealed that the output growth had a significant positive impact on productivity growth and thus, domestic companies had a higher productivity growth as compared to foreign-owned companies. Kumar

International Journal of Research in Entrepreneurship & Business Studies
eISSN-2708-8006, Vol. 1, issue. 2, 2020, pp. 44-53
https://doi.org/10.47259/ijrebs.125

(2003) revealed that the all-important secondary sector has failed to exhibit perceptible forward and backward linkages with income from other sectors.

Nagaraj (2005) revealed that fixed investment will augment infrastructure supply and agricultural productivity towards the revival of long-term finance to boost industrialization, and small and medium enterprises (SMEs). Trivedi (2004) confirmed the existence of inter-state differences in productivity levels and growth rates were converging to the growth rates of the output of the organized manufacturing sector at the national level.

Angeriz *et.al* (2006) found in levels of technical efficiency, although towards a relatively lower average level of total factor productivity (TFP). Bwalya (2006) revealed that the foreign direct investment (FDI) depends on the interaction between intra-industry and inter-industry productivity effects.

Chang and Robin (2006) found that the empirical evidence for complementarity between R&D and technology imports in the innovation process in the manufacturing industries. Domazlicky *et al.* (2006) revealed that the productivity growth rates do not appear to be as sensitive to capital measurement in-state manufacturing. Gajanan and Malhotra (2007) confirmed the traditional measures exhibit substantial bias that traditional measures of capacity utilization such as minimum capital output ratio and peak-to-peak are not appropriate. Gedajlovic *et al.* (2005) revealed that the importance of making finely grained and contextually relevant distinctions when modelling and evaluating corporate governance relations in manufacturing industries.

Wheeler (2007) revealed that wage dispersion falls significantly as manufacturing industry employment expands. Yasar *et al.* (2006) confirmed that the productivity effect of exporting is present at all points along the conditional output distribution. Unni *et al.* (2001) found that the strategy of physical infrastructure development, leading to industrialisation, has been the main reason for the growth of the state's manufacturing sector. Taymaz and Kiliçaslan (2005) revealed that the engineering industry are established between ‘similar’, relatively advanced firms with complementary assets and technologies.

Tang and Wang (2005) revealed that product market competition has a positive impact on the performance of medium-sized and large-sized manufacturing firms. Rodríguez-Gutiérrez (2007) fall in labour productivity and in the hourly average wage, and to an increase in the total cost of production in manufacturing firms. Pushpangadan and Shanta (2006) revealed that the relationship between the dynamic index of competition and the direction of mobility of firms among manufacturing industries. Pattnayak and Thangavelu (2005) found that the total factor productivity (TFP) support the evidence of improvements in economic efficiency in key Indian manufacturing industries. Mamatzakis (2007) revealed that public infrastructure is cost saving and raises demand for private capital, though some variation in estimations across manufacturing industries.

Research Methodology

Multiple Discriminant Analysis was used to derive a linear combination of the characteristics which “best” discriminate between groups and for considering the entire profile of characteristics common to the industrial machinery in engineering industries as well as the interaction of these properties. The discriminant function was applied to the actual data as a basis for the classification of observation for forming it into one of the mutually exclusive groups. A univariate study, on the other hand, can only consider the measurement used for group assignments one at a time.

Multiple Discriminant Analysis reduced the analyst’s space dimensionality, that is, from the number of different independent variables to (G-1) dimension(s) where G is the number of the original ‘a priori’ groups. Since this analysis is concerned with only two groups, it is transformed into the simplest form, namely one dimension. The discriminant function of the form

$$Z = I_1 X_1 + I_2 X_2 + I_3 X_3 + \ldots\ldots + I_n X_n$$

transforms individual variable values to a discriminant score or Z value which is then used to classify the object. Here, $I_1, I_2, \ldots, I_n$ are Discriminant Coefficients and $X_1, X_2, \ldots, X_n$ are independent Variables.

The discriminant function is a linear combination of variables, called discriminant variables, which yield a score for each object, and based on this score, the classification of industrial machinery in engineering industries has been done.

International Journal of Research in Entrepreneurship & Business Studies
eISSN-2708-8006, Vol. 1, issue. 2, 2020, pp. 44-53
https://doi.org/10.47259/ijrebs.125

Stepwise Inclusion and Removal of Variables

Various methods are used in selecting the discriminating variables to form a discriminant function. One of the reputed methods is the stepwise selection method. This is done using the stepwise regression program that introduces variables one at a time. The criterion for entry at each step is to select the variable that reduces the residual sum of squares as much as possible. Hence, at each step, variables are selected and at every step, from the set of selected variables, one variable is removed if it cannot discriminate effectively. More explicitly, at each step, two steps of variables, namely, Set S and Set N, are formed. Set S contains the variables included in the analysis and Set N contains those not included in the analysis.

At each step, one variable is selected to enter into Set S according to an entering criterion and one will be removed (if possible) from S by a removal criterion. The entering and removal criteria are based on the 'F' value which is computed for each variable as the ratio of the sums-of-squares between-groups and within-groups, thus,

$$F = \; = \frac{Between\ Group\ Variance\ for\ a\ Variable}{Within{-}Group\ VAriance\ for\ a\ variable}$$

In statistical form, $F = \frac{N_g\,[Y_g - Y]^2}{(Y_{pg} - Y_g)2}$

where,

G = number of groups
g = group g, g=1…, G
N_g = number of industrial machineries in group g
Y_{pg} = Industrial machinery p in group g, p = 1 ... N_g
Y_g = group mean (centroid)
Y = overall sample mean

$$Y_g = \frac{1}{g}\,Y_{pg}$$

When this ratio is maximized, it has the effect of spreading the means (centroids) of the G groups apart and simultaneously, reducing the dispersion of the individual points (Industrial Machinery Z value, Y_{pg}) about their respective means. Logically, this test is appropriate because one of the objectives of the Multiple Discriminant Analysis is to identify and utilize those variables which best discriminate between groups and which are most similar within groups.
Thus, at each step one variable from the set of variables is selected based on its discriminating powers compared to these of others. After each selection, based on the discriminating efficiency of the selected variables, some variables (if they exist) are removed. The criterion required to select the best discriminator from the set of variables and to retain them in the set of discriminators is based on the F value (described above), which is required to be at least 2.71. The process was described in the following algorithm:
Step 0: Prepare the Set N and S consisting of variables. Initially, N contains all the independent variables and S is empty.
Step 1: Compute F values for all the variables in Set N. If all F values are less than 2.71, go to step 5; otherwise, proceed to Step 2.
Step 2: Select variables from Set N, for which the F value is maximum. Transfer this variable to set S.
Step 3: The variables in Set S will constitute the discriminant function. The F value for each variable is S and it is computed to decide the contribution of each variable to the total discriminating power of the variables in the Set S. If the F value is less than 2.71 for any variable this cannot be a good discriminator compared to others and it is removed from Set S and transferred to Set N. Others are retained in Set S.
Step 4: Proceed to step 1, with the new sets of S and N.
Step 5: Compute the discriminating function using the variables in the current set S. If the variables in Set S are denoted by

X_1, X_2............... X_m (m<n),

Then the discriminant function is

$Z = I_1 X_1 + I_2 X_2 + I_3 X_3 + \ldots\ldots\ldots + I_n X_n$

where,

International Journal of Research in Entrepreneurship & Business Studies
eISSN-2708-8006, Vol. 1, issue. 2, 2020, pp. 44-53
https://doi.org/10.47259/ijrebs.125

$I_1, I_2, \ldots\ldots, Im$

are found by regression methods by the discriminant functions program itself.

The present study is based on secondary data collected from the CMIE data on industrial machinery engineering companies in India. Ratio analysis, a financial tool, and discriminant analysis, a statistical tool, were combined for the construction of a model to analyse the performance of the engineering industries in India. These ratios were calculated from the financial statements, that is, the Balance Sheets and Profit and Loss Accounts of the engineering industries in India chosen for ten years from 2007-2008 to 2016-17.

Table 2. Calculation of Median Value

#	Weights X (Scores)	No. of Observations F
1 – 4	36	1 each
5 – 6	38	1 each
7 – 9	39	1 each
10 – 13	40	1 each
14	41	1
15 – 20	42	1 each
21	43	1
22 – 23	44	1
24 – 27	45	1 each
28 – 30	46	1 each
31 – 32	47	1 each
33 – 36	48	1 each
37 – 39	49	1 each
40 – 42	50	1 each
43 – 44	51	1 each
45	52	1
46	53	1
47	54	1
48 – 49	55	1 each
50	57	1

The value of the 25.5th item is 45. Hence, it is decided to treat the engineering industries during the study period from 2007-2008 to 2016-17 carrying scores of less than the median value, namely, 45, as less efficiently performing companies and the engineering industries carrying scores of 45 and above as efficiently performing companies.

Table 3. Classification of Engineering Industries during the Study Period from 2007-2008 to 2016-17 in India according to Performance

Sl.No.	Efficiently Performing Companies	Sl.No.	Less Efficiently Performing Companies
1	Alfa Laval (India) Ltd.	1	A C C Machinery Co. Ltd.
2	Bharat Heavy Electricals Ltd.	2	Adarsh Plant Protect Ltd.
3	Cummins India Ltd.	3	Avery India Ltd.
4	Disa India Ltd.	4	Bemco Hydraulics Ltd.
5	Elecon Engineering Co. Ltd.	5	Bharat Earth Movers Ltd.
6	Escorts Ltd.	6	Brady & Morris Engg. Co. Ltd.
7	Flat Products Equipment (India) Ltd.	7	Eimco Elecon (India) Ltd.
8	G G Dandekar Machine Works Ltd.	8	Ema India Ltd.
9	Hercules Hoists Ltd.	9	Gujarat Textronics Ltd.
10	Kabra Extrusiontechnik Ltd.	10	Incon Engineers Ltd.

11	Kirloskar Oil Engines Ltd.	**11**	International Combustion (India) Ltd.
12	Kulkarni Power Tools Ltd.	**12**	Lakshmi Automatic Loom Works Ltd.
13	Manugraph India Ltd.	**13**	M P I L Corpn. Ltd.
14	Praj Industries Ltd.	**14**	Millars India Ltd.
15	Punjab Tractors Ltd.	**15**	Mitsubishi Heavy Inds. India Precision Tools Ltd.
16	Revathi Equipment Ltd.	**16**	Miven Machine Tools Ltd.
17	Sandvik Asia Ltd.	**17**	Nesco Ltd.
18	Shilp Gravures Ltd.	**18**	Paper Mill Plant & Machinery Mfrs. Ltd.
19	Shivagrico Implements Ltd.	**19**	Schlafhorst Engineering (India) Ltd.
20	Stovec Industries Ltd.	**20**	Sirdar Carbonic Gas Co. Ltd.
21	Sulzer India Ltd.	**21**	Vijoy Steel & General Mills Co. Ltd.
22	Suzlon Energy Ltd.	**22**	Walchandnagar Industries Ltd.
23	Swaraj Engines Ltd.	**23**	Windsor Machines Ltd.
24	T R F Ltd.		
25	Thermax Ltd.		
26	V S T Tillers Tractors Ltd.		
27	Wendt (India) Ltd.		

Process of Identification of the set of Best Discriminating Variables [stepwise Inclusion and Removal of Variables Method]

With the identification of the less efficiently performing companies and efficiently performing companies, the process of identification of the set of the best discriminators begins. At the first stage, the group means for every variable is found. To test the individual discriminating ability of variables, the ‘F’ test is used. This test relates the difference between the average value of the ratios in each group to the variability or spread of values of the ratios within each group. The details are given in Table 4.

Table 4. Step-Wise Inclusion and Removal of Variables

#	Variable (Ratio)	Mean		F Value (Step 1)	F Value (Step 2)	F Value (Step 3)
		Poor Performer	Good Performer			
1	CR	1.687	1.762	0.1023	5.1170	2.9977
2	QR	1.393	1.518	0.1758	1.7217	0.0325
3	ITO	3.903	6.993	26.3330	5.5906	2.8159
4	ATO	0.617	1.030	18.8009	6.6537*	-
5	GPNS	-2.202	-0.076	2.2987	0.8164	0.1016
6	NPNS	2.358	0.094	1.0266	0.2177	0.0002
7	NPNW	2.217	0.177	0.9399	1.0093	0.6534
8	WCTO	0.964	23.447	1.3913	0.0144	0.0526
9	CDNW	-5.177	1.214	0.9435	0.9146	0.4399
10	DeptTA	0.571	0.484	1.7093	0.0431	0.2296
11	NSNW	-3.499	2.429	0.9007	0.8515	0.3884
12	WCTA	0.104	0.249	8.1816	0.1609	0.0759
13	STA	0.611	0.971	15.0271	6.0932	0.4403
14	CATDebt	1.370	1.571	1.2423	2.3861	1.5851
15	NPTA	-0.010	0.085	34.1201*	-	-
16	NPCE	-0.070	0.158	2.2000	0.7845	0.1674
17	NPWC	-0.053	2.786	1.1761	0.0507	0.2116
18	TIWC	1.221	26.819	1.3395	0.0100	0.0559
19	TAWC	1.956	16.902	1.5340	0.0993	0.0000
20	TDCE	0.645	1.087	0.2979	2.5824	0.3607

21	FATA	0.285	0.237	1.8402	1.1197	0.2640
22	NWTL	0.087	0.461	6.7612	0.2382	0.7344
23	NPTI	-0.201	0.081	6.0227	0.3858	0.0000
24	SExpS	0.040	0.040	0.0019	0.1030	0.2565
25	NWFA	-2.363	4.193	2.7582	1.2312	1.4610
26	INW	0.121	0.219	1.3241	0.2998	1.3252
27	CANW	-3.583	1.747	0.8060	0.7965	0.3540
28	DE	-0.715	0.164	0.8250	0.9891	0.6650
29	Proprietary	0.087	0.461	6.7612	0.2382	0.7344
30	Solvency	0.530	0.457	1.2899	0.0987	0.3226

* denotes the highest ‘F’ value.

In this first step, out of thirty variables, eight-show F values greater than 3.84. Among the eight variables, the NPTA has the highest ‘F’ value that is 34.1201. Hence, it is treated as the “Best discriminator” in step one and included in Set S. The new ‘F’ values for the variables in Set S after Step 1. In step two, the removal of the twenty-nine variables except the NPTA is used.

Step 2 shows that there are four variables with an ‘F’ value greater than 3.84. Out of the four variables, the ATO has the higher ‘F’ value of 6.6537. Hence, the ATO has been included in Set S. Now, Set S contains the NPTA and the ATO. The ‘F’ values are calculated for the two variables. The new ‘F’ values for the variables in Set S after Step 2. Since ‘F’ values are greater than 2.17 none is removed from the second step.

In the third step, for the remaining twenty-eight variables, new ‘F’ values are found for each variable in Set N and it indicates that none of the variables have an ‘F’ value greater than 3.84. Hence, these are not included in Set S. Since the F values for all the remaining twenty-eight variables are less than 3.84, no variable is selected for inclusion in Set S. Hence, this process of selection is stopped, and the final sets of discriminating variables are found to be the NPTA and the ATO.

The Canonical Discriminant Function

Table 5. Discriminant Coefficient of Variable

Function	Discriminant Co-efficient (Eigenvalue)	Wilks' Lambda	Sig.	Canonical Correlation
1	.953	.512	.000	.699

Discriminant analysis was conducted to determine whether two predictors–efficiently performing companies and less efficiently performing companies could predict the behaviour of the engineering industries in India. The overall Wilk’s Lambda was significant (.512). Hence the group means are not different and there is less relationship between the discriminant score and groups.

Structure Matrix

The structure matrix that finds the usefulness of each variable in the discriminant function. Variables are Highly Influenced within Group Correlation. The variables carrying values below positive 0.3 are NPCE (0.296), NPWC (0.254), WCTO (0.222), TIWC (0.220), TAWC (0.185), GPNS (0.159), QR (0.094), NPNW (0.027), NSNW (0.010), CANW (0.008) and CDNW (0.004). These variables are highly influential in the discriminant function. The Box’s Test of equality of covariance matrices is more than 0.10 level. Hence the covariance matrices were significant (0.723).

Table 6. Classification of Results

		Group	Predicted Group Membership		Total
			Good Performer	**Poor Performer**	
Original /Cross-	Count	Good Performer	25	2	27
		Poor Performer	4	19	23
	%	Good Performer	92.6	7.4	100.0

validated *		Poor Performer	17.4	82.6	100.0

* 88.0% of original grouped cases correctly classified

The correctly classified cases appear on the diagonal of the Classification Table 6; hence of the 27 companies in the efficiently performing group, 25 (92.6%) were predicted correctly and of the 23 companies in the less efficient performing group, 19 (82.6%) were predicted correctly. The cross-validated classification is generated by choosing the leave-one-out option within the classification dialog box. With the leave-one-out option, the classification functions are derived based on all cases except one, and then the left-out case is classified. Overall 88 percent of the cases were correctly classified.

Suggestions

- The government of conventional commercial banks has to explore positions of further expansion of financing engineering industries. They may also think of more inviting and easier schemes to attract young, qualified engineering technocrats to entrepreneurship.
- The government can also sponsor agencies to train entrepreneurs of engineering industries in management financing and marketing and expand their technical mastery.
- The electricity boards in the country, now under government monopoly, have to be made more user-friendly and more responsive to high and users and their needs so that they do not have to resort to private, captive power generations at a high cost. The availability of a reliable power supply is an obligation the government owes to all. Alternative sources to electric power, the generation of such power, and the empowerment of agencies capable of such power generation on a competition model are all necessary steps in the present scenario of liberalization and globalization.
- Global market surveys in terms of needs and demands in different segments of the market are important so that the expert market is sensitively tapped along with the domestic market. A mode of running the business with comprehensive research in R&D is essential.
- The pursuit of modernization, in fully hardening the resources of information technology should be relentless. It is a field that demands great attention and expertise.

References

1. Angeriz, A., McCombie, J., & Roberts, M. (2006). Productivity, efficiency and technological change in European Union regional manufacturing: A data envelopment analysis approach. *The Manchester School*, *74*(4), 500-525. https://doi.org/10.1111/j.1467-9957.2006.00506.x
2. Balakrishnan, P., & Babu, M. S. (2003). Growth and distribution in Indian industry in the nineties. *Economic and Political Weekly*, 3997-4005. https://www.jstor.org/stable/4414048
3. Baldwin, J. R., & Gu, W. (2006). Plant turnover and productivity growth in Canadian manufacturing. *Industrial and Corporate Change*, *15*(3), 417-465. https://doi.org/10.1093/icc/dtj017
4. Bwalya, S. M. (2006). Foreign direct investment and technology spillovers: Evidence from panel data analysis of manufacturing firms in Zambia. *Journal of development economics*, *81*(2), 514-526. https://doi.org/10.1016/j.jdeveco.2005.06.011
5. Chang, C., & Robin, S. (2006). Doing R&D and/or importing technologies: The critical importance of firm size in Taiwan's manufacturing industries. *Review of Industrial Organization*, *29*(3), 253-278. https://doi.org/10.1007/s11151-006-9114-8
6. Domazlicky, B. R., & Weber, W. L. (2006). The measurement of capital and the measurement of productivity growth and efficiency in-state manufacturing. *International Regional Science Review*, *29*(2), 115-134. https://doi.org/10.1177/0160017606286273
7. Gajanan, S., & Malhotra, D. (2007). Measures of capacity utilization and its determinants: a study of Indian manufacturing. *Applied Economics*, *39*(6), 765-776. https://doi.org/10.1080/00036840500447732
8. Gedajlovic, E., Yoshikawa, T., & Hashimoto, M. (2005). Ownership structure, investment behavior, and firm performance in Japanese manufacturing industries. *Organization Studies*, *26*(1), 7-35. https://doi.org/10.1177/0170840605046346
9. Kumar, S. (2003). Inter-temporal and inter-state comparisons of total factor productivity in Indian manufacturing sector: An integrated growth accounting approach. *Antha Vijnana*, XLV(3-4), 147-160. https://dspace.gipe.ac.in/xmlui/bitstream/handle/10973/28091/av-2003-sep-dec-2-abs.pdf?sequence=2
10. Kumari, A. (2006). Productivity growth in Indian engineering industries during pre-reform and post-reform periods: an analysis at company level. *India: Industrialisation in a Reforming Economy, Essays for KL Krishna, Academic Foundation, New Delhi*, 107-140

11. Mamatzakis, E. C. (2007). EU infrastructure investment and productivity in Greek manufacturing. *Journal of Policy Modelling*, *29*(2), 335-344. https://doi.org/10.1016/j.jpolmod.2006.12.002
12. Nagaraj, R. (2005). Industrial growth in China and India: A preliminary comparison. *Economic and Political Weekly*, 2163-2171. https://www.jstor.org/stable/4416672
13. Pattnayak, S. S., & Thangavelu, S. M. (2005). Economic reform and productivity growth in Indian manufacturing industries: an interaction of technical change and scale economies. *Economic Modelling*, *22*(4), 601-615. https://doi.org/10.1016/j.econmod.2004.09.005
14. Pushpangadan, K., & Shanta, N. (2006). Competition in Indian manufacturing industries: A mobility analysis. *Economic and Political Weekly*, 4130-4137. https://www.jstor.org/stable/4418754
15. Raveendran, A. (2003). Financial Performance of Engineering Industry in Kerala. *Indian Economic Journal*, 50(3/4), 64-86.
16. Rodríguez-Gutiérrez, C. (2007). Effects of temporary hiring on the profits of Spanish manufacturing firms. *International Journal of Manpower*, 28(2), 152-174. https://doi.org/10.1108/01437720710747974
17. Tang, J., & Wang, W. (2005). Product market competition, skill shortages, and productivity: Evidence from Canadian manufacturing firms. *Journal of Productivity Analysis*, *23*(3), 317-339. https://doi.org/10.1007/s11123-005-2213-y
18. Taymaz, E., & Kiliçaslan, Y. (2005). Determinants of subcontracting and regional development: An empirical study on Turkish textile and engineering industries. *Regional Studies*, *39*(5), 633-645. https://doi.org/10.1080/00343400500151913
19. Trivedi, P. (2004). An inter-state perspective on manufacturing productivity in India: 1980-81 to 2000-01. *Indian Economic Review*, 203-237. https://www.jstor.org/stable/29793811
20. Unni, J., Lalitha, N., & Rani, U. (2001). Economic reforms and productivity trends in Indian manufacturing. *Economic and Political Weekly*, 3914-3922. https://www.jstor.org/stable/4411233
21. Wheeler, C. H. (2007). Industry localization and earnings inequality: Evidence from US manufacturing. *Papers in Regional Science*, *86*(1), 77-100. https://doi.org/10.1111/j.1435-5957.2007.00107.x
22. Yasar, M., Nelson, C. H., & Rejesus, R. (2006). Productivity and exporting status of manufacturing firms: Evidence from quantile regressions. *Review of World Economics*, *142*(4), 675-694. https://doi.org/10.1007/s10290-006-0088-2