Bus Transport Efficiency Measurement with Reference to MSRTC Bus Depots of Kolhapur Division

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Abstract

Since independence, most state governments have nationalized the bus transport system either completely or partially. Taking all States together, nationalized bus services now account for about 40 per cent. The Maharashtra State Road Transport Corporation (MSRTC) standing today by milestone of 50 years, its position of strength speaks for itself - 16,000-odd buses, 12,000 employees, about 70 lakh citizens utilizing the services daily. The physical and operating efficiency of the State Road Transport Undertakings [SRTUs] as a whole is low. The major causes of these losses are gross inefficiency, extensive pilferage of stores, poor maintenance of buses, absence of a cost-based fare structure and lack of timely adjustment of fares in response to changes in input prices, operation of uneconomic routes for social reasons, etc.

There is a strong public feeling that states governments by and large are unfit to run bus service efficiently and should hand them over to private operators. The paper tries to rank the depots of Kolhapur division of the Maharashtra State Road Transport Corporation on the basis of nineteen [19] performance variables. The author uses Morris, M. D. and Liser, P. B., (1977) procedure for construction and use of performance index in the paper. The study brings out in quantitative terms certain interesting aspects of performance of the depots and calls for a deliberate policy action and initiatives to reduce performance variation in the Kolhapur division.

Keywords: Bus transport, state road transport undertakings, bus depot, efficiency measurement, disparity.

Introduction

Bus transport is now undertaken by State Governments. Since independence, most state governments have nationalized the bus transport system either completely or partially. Taking all States together, nationalized bus services now account for about 40 per cent. There are currently 60 State Road Transport Undertakings (SRTUs) with a total fleet of over 1,00,000 buses with a total investment of over Rs. 5,000 crores and a direct employment of over 1.5 million people and they carry 45 million passengers every day.

The state governments are constantly attempting to nationalize more and more road routes. The important arguments given in favour of nationalization of bus transport are as follows:

i. Road transport is a public utility service and as such should be in the hands of the State.

ii. Road transport brings in large revenue for the state, which can be used for economic development.

iii. Nationalization of road transport helps to bring co-ordination between road and railway transport.

iv. It also eliminates competition between bus transport companies.

v. It brings in advantages of large-scale operation.

vi. Facilities that are not available to small bus companies are available to the large government road transport corporations.

vii. The state road undertaking can provide better facilities to the passengers and good working conditions to the employees.

viii. Utility based additional services.

ix. Value added services.

Research Problem

The Maharashtra State Road Transport Corporation (MSRTC) standing today by milestone of 50 years, its position of strength speaks for itself - 16,000-odd buses, 12,000 employees, about 70 lakh citizens utilising the services daily. The physical and operating efficiency of the State Road Transport Undertakings [SRTUs] as a whole is low. Many of

the SRTU's buses and the services they provide to the general public are a disgrace. The overall financial result of the SRTUs is disappointing and the total accumulated losses are over Rs.2500/-crores.

The major causes of these losses are gross inefficiency, extensive pilferage of stores, poor maintenance of buses, absence of a cost-based fare structure and lack of timely adjustment of fares in response to changes in input prices, operation of uneconomic routes for social reasons etc.

There is a strong public feeling that state governments by and large are unfit to run bus service efficiently and should hand them over to private operators.

Need of an Hour

Today, in the 21st century, there is no denying fact that globally, there is a performance development "gap" not only between industries but also within them at firm level and this gap varies among organizations. Service sector is now the most upcoming sector in the economy under economic reforms era. However even Service sector and related activities are not evenly spread throughout the state and are observed to cause a development 'gap' within the state.

Few studies had highlighted the persistent "performance development gap and inefficiency" within the industry, relating to State Road Transport Undertakings. All these studies mainly concentrated on few general indicators and some of them belong to pre economic reforms era. Thus, the present paper considers as good as nineteen [19] variables to assess the depots of Kolhapur division of the Maharashtra State Road Transport Corporation.

Objective of the Study

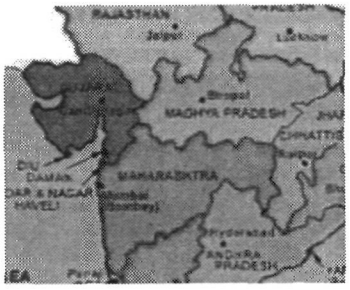
The present work basically aims at identification of levels of performance of the depots of Maharashtra State Road Transport Corporation of the Kolhapur division. The paper tries to rank the depots on the basis of the performance.

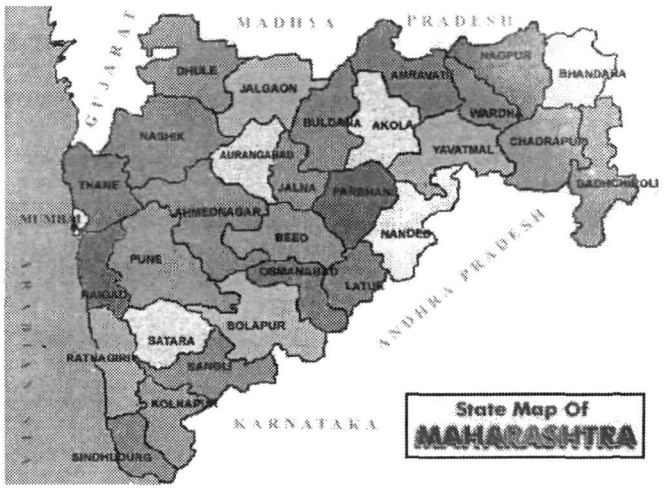
Research Design

This section consist the following aspects:

Selection of the Study Area

The Maharashtra state is one of leading developed state in the county and being top in many macro economic variables, such as per capita income, industry development service sector, finance, banking, insurance and technology. The technology. The state had made enormous economic progress in last fifteen years of economic reforms era, but the performance and benefits of the growth were uneven among the various sector and regions of the state. The performance of private and public sector and regions of the state. The performance of private and public sector was much debatable. The private sector units had shown a tremendous growth during reforms era.





On the other hand, public sectors like Maharashtra State Road Transport Corporation (MSRTC) were in old traditional method of function that was resulted in inefficiency leading to performance imbalance. Some depots had shown record growth and others were badly hampered.

Keeping the objectives of study in mind the jurisdiction of Maharashtra State Road Transport Corporation (MSRTC) of Kolhapur division was selected on convenient basis. This division consists of twelve depots and all the depots were taken for study the objectives of the paper.

Performance Indicators

In this paper, the level of overall performance of the depots of Maharashtra State Road Transport Corporation of the Kolhapur division will be captured through twenty-six (26) variables. List of all these indicators is presented below:

Table 1: List of Performance Indicators with Respective Weight

List of Performance Indicators		Weight
X_1	No of Buses	0.0523
X_2	No of Routes	0.0487
X_3	No of Schedules	0.0523
X_4	Staff per Schedules	0.0493
X_5	No of Labour Staff per Bus	0.0552
X_6	Staff on Road per Vehicle	0.0548
X_7	Route K.M. per Bus	0.0525
X_8	Average No of Buses on Road	0.0519
X_9	No of Passengers Carried per Bus (In Lakh)	0.0535
X_{10}	No. of Students Traveling by Concession	0.0551
X_{11}	No of Others Traveling by Concession	0.0479
X_{12}	No of Accidents	0.0474
X_{13}	No of Breakdown per 10,000 K.M.	0.0502
X_{14}	Total Traffic Receipt per bus	0.0517
X_{15}	Traffic earning per vehicle per day	0.0517
X_{16}	Traffic earning per K.M.	0.0563
X_{17}	Net Earning per bus	0.0492
X_{18}	Net Cost per bus	0.0625
X_{19}	Profit Margin per bus	0.0574
Total		1.0000

Sources and Methods of Data Collection

Secondary data was collected from a) published and unpublished materials in the form of books, reports, journals and periodicals, related to bus and road transportation and b) electronic sources, such as internet, e-mail, browsers and websites, online databases which involves twelve depots and nineteen (19) variables. The data reference year was 2006-2007.

Methods of Analysis and Statistical Tools

Morris, M. D. and Liser, P. B., (1977) provided procedure for construction and use of performance index, and used by Mukherjee, (1980), Iyengar N. S., and Sudarshan P., (1982). In this paper, researcher had employed same methodology, which is as follows:

Let X_{id} represent the size or value of the i^{th} performance indicator in the d^{th} depot of Kolhapur division, (I = 1, 2,.....m; d = 1, 2, ...n, say).

Let us write $Y_{id} = \frac{X_{id} - Min_d X_{id}}{Max_d X_{id} - Min_d X_{id}}$ ----------1

Where, $Min_d X_{id}$ and $Max_d X_{id}$ are respectively, the minimum and maximum of $(X_{i1}, X_{i2}, \ldots\ldots X_{im})$.

If however, X_i is negatively associated with the status of performance, equation no. 1 can be written as:

$$Y_{id} = \frac{Max_d X_{id} - X_{id}}{Max_d X_{id} - Min_d X_{id}} \quad \text{---------- 2}$$

Obviously, the scaled values, $Y_{id,}$ vary from zero to one. From the matrix of scaled values, Y = $((Y_{id}))$, we may construct for the overall level of performance for the different depots of the Kolhapur division as follows:

$$\bar{Y}_d = W_1 Y_{1d} + W_2 Y_{2d} + W_3 Y_{3d} + \ldots\ldots\ldots W_m Y_{md} \quad \text{--------- 3}$$

Where the w's ($0< w_i<1$ and $w_1 + w_2 + \ldots\ldots\ldots\ldots\ldots w_m = 1$) are arbitrary weights reflecting the relative importance of individual indicators. A special case of this is when the weights are assumed equal.

However, a more rational and meaningful step would be to assume that the weights vary inversely as the variation in the respective indicator of performance. More specifically, researcher assumes:

$$W_i = \frac{K}{\sqrt{Var(Y_i)}} \quad \text{---------- 4}$$

Where

$$K = \left[\sum_{i=1}^{m} \frac{1}{\sqrt{Var Y_i}}\right]^{-1} \quad \text{---------- 5}$$

The over all depot index of performance, $\bar{Y}_d$ also varies from zero to one. The choice of the weights in this manner ensures that large variation in any one of the indicators will no unduly dominate the contribution of the rest the indicators and distort the inter-depot comparison. It is well kwon that, in statistical comparison it is more efficient to compare the two or more means after equalising their variance.

For classification purpose, a simple ranking of the over all depot index of performance, $\bar{Y}_d$ would do. However, a more meaningful characterisation of the different stages of performance would be in terms of suitable fractile classification from an assumed distribution of $\bar{Y}_d$ It appears appropriate to assume that $\bar{Y}_d$ has a Beta distribution in the range (0, 1). The Beta distribution is generally skewed and perhaps relevant to characterised positive valued random variables.

A random variable Z, has a Beta distribution in the interval (0,1) if its probability density function, f(z), can be written as:

$$f(z) = \frac{1}{B(a,b)} z^{a-1}(1-z)^{b-1},$$

$0<z<1$ and $a, b>0$ ----------6

Where B (a, b) is integral

$$B(a, b) = \int_0^1 z^{a-1}(1-z)^{b-1} \quad \text{----------7}$$

Let $(0, z_1)$, (z_1, z_2), (z_2, z_3), (z_3, z_4) and $(z_4, 1)$ be linear intervals that each interval has the same probability weight of twenty percent. The fractile groups can be used to characterize the various stages of performance. Suppose one adopt the following definitions of performance, excluding the extreme cases of z = 0, 1.

E Very Poor Performing Depots if $0 < \bar{Y}_d \leq Z_1$

D Poor Performing Depots if $Z_1 < \bar{Y}_d \leq Z_2$

C Average Performing Depots if $Z_2 < \bar{Y}_d \leq Z_3$

B Good Performing Depots if $Z_3 < \bar{Y}_d \leq Z_4$

A Excellent Performing Depots if $Z_4 < \bar{Y}_d \leq 1$

The parameters of Beta distribution (a, b) in the assumed Beta distribution can be estimated by solving the following simultaneous equations:

$(1- \bar{Y}_d)a - \bar{Y}_d b = 0$

$(\bar{Y}_d - m_2)a - m_2 b = m_2 - \bar{Y}_d$ ---------- 8

Where, $\bar{Y}_d$ the overall mean of the depot indices and m_2 is given by

$$m_2 = S_{\bar{y}}^2 + y^2 \quad \text{----------9}$$

Where, $S_{\bar{y}}^2$ is the variance of the depot indices. The cut-off points z_1 to z_4 can be obtained from the tables of incomplete Beta distribution or from table of F-distribution with degree of freedom (2a, 2b) which readily available.

If $F_{n1, n2; p}$ is the value of the F-statistics with $_{n1}$ and $_{n2}$ degrees of freedom corresponding to probability p i.e,

$$Pr(F \leq F_{n1, n2; p}) = p \quad \text{----------10}$$

Then

$$F_{n1, n2; p} = \frac{n_2}{n_1} \frac{1 - z_p}{z_p} \quad \text{----------11}$$

Where z_p is the p^{th} fractile of the corresponding Beta distribution. Hence in this case z_p is given by

$$z_p = \frac{1}{1 + \frac{b}{a} F_{n1, n2; p}} \quad \text{----------12}$$

Since $n_1 = 2a$, $n_2 = 2b$. Extensive tables are available for computing the fractile points on F-distribution for selected values of (n_2, n_1) and p.

For values of F not readily available in the tables, a two-way interpolation is needed. A straightforward procedure would be as follows:

For values of p less than 0.5, let $F_{n2k, n1k}$ be the tabulated values of F- ratio with degrees of freedom (n_{2k}, n_{1k}) for given fractile point on the F distribution, taking k = 1 and k = 2, researcher wish to compute say $F_{n2, n1}$ for values of (n_2, n_1) where $n_{21} < n_2 < n_{22}$) and $n_{11} < n_1 < n_{12}$. It is easy to show that:

$$F_{n2, n1} = F_{n21, n11} + \frac{n_2 - n_{21}}{n_{22} - n_{11}} (F_{n22, n11} - F_{n21, n11})$$

$$+ \frac{n_1 - n_{11}}{n_{12} - n_{11}} + (F_{n21, n12} - F_{n21, n11}) +$$

$$\frac{(n_2 - n_{21})(n_1 - n_{11})}{(n_{22} - n_{21})(n_{12} - n_{11})} [F_{n21, n11} + F_{n22, n12} - F_{n21, n11} - F_{n22, n11}]$$

However for p>0.5 the following result holds:

$$F_{n1, n2; p} = \frac{1}{F_{n1, n2}, 1 - p}$$

Results and Discussions

➢ Performance Disparity:

The indices of performance $\bar{Y}_d$ are presented in the Table No. 2 for all the depots of MSRTC of the Kolhapur division with their relative ranking.

Table 2: The Performance Indices of the Depots of MSRTC of the Kolhapur Division with Their Relative Ranking.

MSRTC Depots	Performance Index $\bar{Y}_d$	Rank
Gadhinglaj	0.5379	1
Kolhapur	0.5371	2
Ajara	0.5303	3
Inchalkaranji	0.5283	4
Kurundwad	0.5151	5
Gargoti	0.5073	6
Chandgad	0.4984	7
Kagal	0.4824	8
Sambhajinagar	0.4761	9
Malkapur	0.4442	10
Radhanagari	0.4109	11
Gaganbawada	0.3599	12
Mean of Index for the Depots = 0.486, Standard Deviation = 0.697 and Coefficient of Variation = 143.50		

The Table No. 2 paints out that there was variation among of the depots of MSRTC of Kolhapur district in terms Performance. Gadhinglaj has the distinction of being the top with index score 0.5379 and highly performing depot in the Kolhapur division, while Gaganbawada remains at lowest position and at most bottom in the list of twelve depots of the division with index score of Performance 0.3599. The difference between two index scores of two extreme performing depots was 0.1780. The mean index score of performance for all the depots was 0.4860, standard deviation was 0.697 and coefficient of variation for the state was 143.50 per cent. This was clear evidence of performance disparity among the depots of MSRTC of the Kolhapur division in terms of all Performance indicators.

The indices of performance $\bar{Y}_d$ are further graduated using Beta distribution with the estimated parameters, a = 38.8842 and b = 41.1824. The twenty (20) percent cut-off points estimated to be: $z_1 = 0.3065$, $z_2 = 0.4402$, $z_3 = 0.5043$ and $z_4 = 0.5370$.

Based on these calculations, the depots of MSRTC of the Kolhapur division are classified in to five clusters according to their status of performance, as shown in the Table 3.

Table 3: Status of Performance of the Depots

Stages of Performance	Criterion	Depots of State	No.
Very Poor Performing Depots	$0 < \bar{Y}_d \leq Z_1$	Nil	00
Poor Performing Depots	$Z_1 < \bar{Y}_d \leq Z_2$	Gaganbawada & Radhanagari	02
Average Performing Depots	$Z_2 < \bar{Y}_d \leq Z_3$	Malkapur, Sambhajinagar, Kagal & Chandgad	04
Good Performing Depots	$Z_3 < \bar{Y}_d \leq Z_4$	Gargoti, Kurundwad, Inchalkaranji & Ajara	04
Excellent Performing Depots	$Z_4 < \bar{Y}_d \leq 1$	Kolhapur & Gadhinglaj	02
Total			12

The Table No.3 reveals that out of 12 depots of Maharashtra State Road Transport Corporation of the Kolhapur division, none of the depots were fallen in the category of Very Poor Performing Depots. The Gaganbawada & Radhanagari depots were in Poor Performing category in terms of Performance.

Among the twelve depots of Maharashtra State Road Transport Corporation of the Kolhapur division, four depots namely Malkapur, Sambhajinagar, Kagal & Chandgad found the home in the category of Average Performing Depots. Gargoti, Kurundwad, Inchalkaranji & Ajara were in the class of Good Performing Depots. Only Kolhapur & Gadhinglaj were in the category of Excellent Performing Depots.

The study brings out in quantitative terms certain interesting aspects of performance of the depots of Maharashtra State Road Transport Corporation of the Kolhapur division. The study therefore, calls for a deliberate policy action and initiatives to reduce performance variation in the Kolhapur division. All depots in general and some depots need special attentions from all the directions.

References

Das, Keshab (2004), Uneven Development and Regionalism: A Critique of Received Theories, Economic and Political Weekly, Vol. 39, No. 45,

Dreze Jean and Amartya Sen (2002), India: Development and Participation, Oxford University Press, New Delhi.

Economic Times, Regional Disparity Widens; Rich States Corner Benefits, September 2005.

Ghosh, Buddhadeb and Prabir De (2004), How Do Different Categories of Infrastructure Affect Development: Evidence from Indian States, Economic and Political Weekly, Vol. 39, No. 42.

Harris, Nigel (2005), Towards New Theories of Regional and Urban Development, Economic and Political Weekly, Vol. 40, No. 7.

Kurian, N J (2000), Widening Regional Disparities in India: Some Indicators, Economic and Political Weekly, Vol. 35, No. 7.

Morris, M. D. and Liser. P. B., (1977), The PQLI: Measuring Progress in Meeting Human Needs, Overseas Development Council, Communiqué on Development Issues, Vol. No. 32.

Mukherjee M., (1980), Physical Quality of life Index, CMIE, Mumbai.

Prabhu, K Seeta and P C Sarkar (1992), Identification of Levels of Development - Case of Maharashtra, Economic and Political Weekly, Vol. 27.

Viner Jacob, (1953) International Trade and economic Development, OUP, Delhi.

Web References

www.stats.gov.cn/english/statisticaldata/yearly data

www.answers.com/topic-Vidarbha_is_backward

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