Diagnostics of Operational Performance of the SLTB: Causal Factors and Insights for Further Improvement

Sri Lanka Journal of
Economic Research
Volume 8(1) December 2020
SLJER 08.01.03: pp. 53-78
Sri Lanka Forum of
University Economists
DOI: http://doi.org/10.4038/sljer.v8i1.124

T L Gunaruwan

D M T N Herath

Abstract

Sri Lanka Transport Board (SLTB), the State-owned public bus transport provider in Sri Lanka has recorded improved financial performance during the post-2015 period, and earned net financial surplus in 2017, a rare occurrence for the persistently loss-making state-owned enterprise. This apparent performance turn-around was the seed for the present study which attempted to identify causal factors behind this improvement, its sustainability, and to assess the scope for further improvement. The study used data in the published Reports of SLTB (2009-2017) and deployed analytical techniques such as descriptive statistics and regression analysis. Results revealed that the perceived performance improvement has been driven mainly by augmented revenues earned through increased average fare per kilometre and by the reduced fixed costs owing to the implementation of a Volunteer Retirement Scheme (VRS), both are attributable to government policy initiatives more than to any managerial decisions or operational improvements. The fuel cost management, and maintaining load factors over the years, have not been satisfactory, questioning the sustainability of the reported financial performance improvement. The outcome of the study thus calls for closer attention on improving technical and operational aspects of the SLTB.

Keywords: *Bus Transportation; SLTB; Operational Performance; Causal Factors; Fuel Efficiency*

T L Gunaruwan (Corresponding Author)
Department of Economics, University of Colombo, Sri Lanka.
Email: tlgun@econ.cmb.ac.lk   Tel: +94 77 228 2808   https://orcid.org/0000-0003-0972-9554

D M T N Herath
Department of Economics, University of Colombo, Sri Lanka
Email: thanuja.nilmi.tn@gmail.com

INTRODUCTION

Sri Lanka Transport Board (SLTB), hailing from the nationalization of the bus industry that came into effect in 1958 (Sri Lanka Transport Board, 2011), is the single largest provider of public bus transport services in Sri Lanka. With its fleet of over 6000 buses,[1] it caters to approximately 8.4% of the total public passenger transport demand in Sri Lanka (National Transport Commission, 2015),[2] where nearly 55% motorized transport needs met through public transport modes.[3] Being a State-owned entity, SLTB is not merely a profit-seeking enterprise, but an organization operating with social and national development objectives such as providing bus services in rural areas and uneconomical routes, operating late night services and school bus services (Ministry of Transport and Civil Aviation, 2018).

Nevertheless, incurring financial losses had been a frequent problem associated with the SLTB. Figure 1 depicts the financial performance of SLTB from 2009 onwards, and it is evident that, excluding the year 2017, the organization had incurred losses, even though there has been a favourable trend in profitability after 2015.

The organization was persistently blamed for its inefficacy and mismanagement that has led to these substantial financial losses (Kumarage A. S., 2012). These financial losses not only had adverse effects on internal liquidity and performance of SLTB but also had implications on the national budget by way of having had to finance revenue shortfalls.

As reflected in the Figure 1, the SLTB has managed to report an improving trend in financial performance after 2015, culminating into recording a surplus after depreciation[4] of Rs 2.81 per operated bus kilometre in 2017.

This is a rare achievement for a state-sector organization which had hitherto incurred losses and warrants researching into. Moreover, because numerous efforts that had been made in the past, including through institutional reforms and restructuring undertaken in the 1980s and 1990s, to improve the financial performance of the service provider, though resulted in a few short-lived improvements, SLTB has not been capable of generating any sustainable profitability turn-around.

---

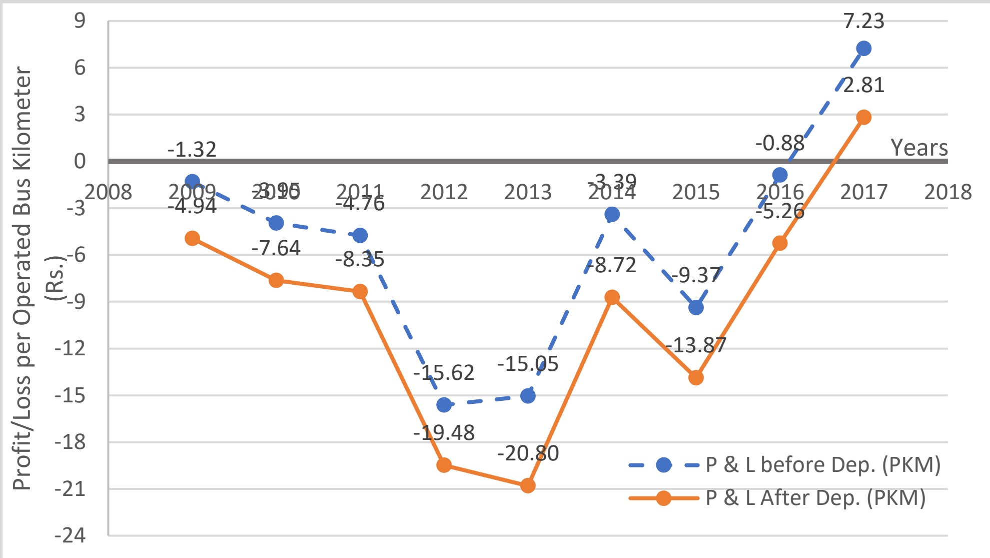
[1] The private operators together had a bus fleet of around 19400 as at end 2016. Yet, no single private sector operator has this size of a large bus fleet in Sri Lanka.

[2] This is the largest modal share catered to by any single public transport operator, and therefore could be recognized as the foremost public transport service provider in Sri Lanka.

[3] Estimated public transport modal share, as per the National Transport Statistics-2017, quoting a different source, was 43% by 2016 (National Transport Commission, 2017)

[4] Profit after depreciation was calculated excluding government subsidies as revenue, only Operational Revenue was considered.

Figure 1: SLTB's Profit/ (Loss) Before and After Depreciation (2009-2017)



Source: Sri Lanka Transport Board

The present research was therefore conducted with the objective of deep diving into the trends of the financial performance of the SLTB. It aimed at investigating trends of contributory variables, their sub-components, and managerial actions in particular, given understanding the factors behind this favourable turn-around leading to gradual improvement of performance after 2015, culminating into the exceptional performance of SLTB realizing a profit after depreciation in 2017. Further, the study also intended to identify managerial weakness and scope for further improvement, in view of making appropriate policy and strategic recommendations.

LITERATURE REVIEW

Performance in public bus service provision: Importance and Experience

Bus service is the most widely used mode of public transport world over due to its flexibility, high availability, and accessibility (Rohani, Wijeyesekera, & Karim, 2013), which is extremely important vis-à-vis social and economic development, particularly of developing countries (Gunaruwan & Jayasekara, 2015). In India, Public bus transit is the accessible, reliable, convenient and affordable transport mode of low-income earners (Badami & Haider, 2007).This is because, public transport, and particularly bus transportation, would provide mobility for the general public at economical costs (Agarwal & Singh, 2010) and enhance the productivity of businesses (Berhan, Beshah, & Kitaw, 2013), and thereby would support economic activities (Jakob, Craig, & Fisher, 2006) (Pojani & Stead, 2015).

Public bus services in most developing countries are subsidized to achieve social objectives; yet, their revenues are very low (Abreha, 2007). Boujelbene and Derbel (2015) have found that the high share of individual transport[5] in Tunisia having a negative effect on the efficiency of public transportation with more irregularity and less punctuality of services (Boujelbene & Derbel , 2015). In India, bus and labour productivity and fuel efficiency in secondary cities are significantly lower than in metropolitan centres. Although bus fleet, operating kilometres, fuel consumption and employees have increased in secondary cities, they have been unable to attract more passengers and to increase load factors, thus resulting in greater financial deficits (Badami & Haider, 2007). Therefore, keeping track of service provision efficacy is an important criterion in view of reducing the burden on public coffers to maintain the operations, particularly when public bus services are provided by State-owned enterprises.

In the Sri Lankan context, SLTB is a government-owned organization which has heavy operational and management inefficiencies (Kumarage A. S., 2012). Three major problems have been identified in bus transportation in Sri Lanka; namely, high and increasing deficits, poor operational behaviour, poor targeting of subsidies (Gwilliams, 2005)[6].

Although SLTB has been successful in providing welfare services, thus paving the way for social inclusivity, it has failed to reach efficient financial viability due to its high fixed costs, low service operation levels, and heavy debts (Gunaruwan, 2015). Even though the Ceylon Transport Board (CTB), the predecessor of SLTB, in its early years, showed improved operational performances such as vehicle utilization, workers satisfaction, and financial stability compared to private bus companies that existed before nationalization in 1958 (Kumarage A. S., 1999).

Importance of operational performance assessment and means

Performance measurements of public transport operations help understand the degree of achievement of pre-defined goals, to set plans, to allocate resources, and to make policy decisions to further improve the system (Olafsdottir, 2012). Financial profit though is not the sole indicator of service provision efficacy, it constitutes the overall difference between costs incurred and revenues earned; thus, it mirrors a measure of performance of the bus operator. Among other factors affecting public transport effectiveness are the number and the quality of buses and bus stops, the number of passengers carried, fuel

---

[5] In the three major cities of Tunisia (Tunis, Sfax, Sousse), the share of individual transport is about 60-70% against 30-40% for public transit.

[6] The State bus sector in Sri Lanka is receiving a number of explicit and hidden subsidies. Explicit subsidies are wage subsidy, uneconomic route subsidy, scholar fare passes, subsidies for costs of SLCTB, subsidies for the direct purchase of tires etc. And also, unpaid permission fees, unpaid terminal fees, subsidies for uncovered depreciation and operating losses are examples for hidden subsidies. (Gwilliams, 2005).

consumption efficacy, servicing of uneconomic routes, and environmental issues (Agarwal & Singh, 2010). According to Matsuo (2015), service production and service consumption processes associated with transportation depend on the concepts of efficiency and effectiveness (Matsuo, 2015). Resource inputs to a given transport service outcome measures production efficiency, where the capital, labour, and fuel are inputs and vehicle revenue hour or vehicle revenue miles are outcomes. Service effectiveness is the proportion of transport service production to service consumption by passengers. Korattyswaroopan (2010), apparently looking at the service production side, recognizes transport efficiency as composed of vehicle efficiency, labour efficiency, and fuel efficiency (Korattyswaroopan, 2010).[7] For Abreha, there are five main categories of public transport efficiency, namely, system efficiency, network operating efficiency, labour efficiency, utilization efficiency, and financial efficiency (Abreha, 2007). Boujelbene and Derbel (2015) consider that measuring the performance of the public transport sector is a combination of economic criteria, efficiency criteria, effectiveness criteria and quality of service criteria (Boujelbene & Derbel , 2015).

According to Armstrong-Wright & Thiriez (1987), bus service operating cost including fuel consumption[8] and labour costs, depreciation and interest, passenger volume carried per bus, fleet utilization,[9] operated vehicle kilometres,[10] level of service breakdowns,[11] staff ratio, and accidents are the performance indicators usable in the transport sector (Armstrong-Wright & Thiriez, 1987).

METHODOLOGY

The present research used financial statements and records that are published by the SLTB, as the window of entry to deep diving into operational performance diagnostics. Since financial surpluses in operation could be resulted from improved revenues, reduced costs, or both, the research analysed their trends and those of their sub-components in

[7] Vehicle km per bus or passenger km per bus reflects vehicle efficiency. Passenger km or vehicle km per employee measures Labor efficiency. Vehicle or passenger km per litre of fuel is fuel efficiency measurements.

[8] Size and load of vehicles, Engine type, and the gradients and traffic conditions of roads are key factors that influence the level of fuel consumption efficiency. (Armstrong-Wright & Thiriez, 1987).

[9] Fleet utilization is the total operated buses as a percentage of the total fleet. This is a direct indicator of technical productivity. Fleet utilization indicates the effectiveness of bus maintenance, procurement and cost of spares, stock keeping and staff recruitment and management. Lack of maintenance facilities or skills, problems of supplying spare parts, tires, fuels, and labour or union problems have an adverse impact on fleet utilization. (Armstrong-Wright & Thiriez, 1987).

[10] This measure (average kilometers per operating bus per day) is an indicator of the operational productivity of the bus fleet. (Armstrong-Wright & Thiriez, 1987).

[11] In India, high breakdown rates prevent utilization of more than 60-70% of the public bus fleet during peak periods.

depth. Revenue generation, for instance, would be in two forms: namely, "revenue from operations" and "non-operating revenues".[12] Revenue from operations, the focus of this paper, is the sum of Way-bill Revenue (Ticket revenue collected by conductors), and "other operations-related revenue" (such as season ticket sales, reimbursements on travel passes and school season concessions, revenue from hires, and compensatory payments on welfare services operated by the SLTB on the government's request).[13] Way-bill Revenue is collected from passengers purchasing tickets at the authorized fare level (Fare per passenger-km).

Thus, the total Way-bill Revenue per day would be a product of the fare level and the passenger-km transported per day; latter variable being a function of (a) the number of operated buses a day, and (b) the Average Vehicle Utilization (AVU)[14] representing the distance an average bus operated per day, (c) the carrying capacity of an average bus, and (d) the average Load Factor (LF) representing the average occupancy level of buses.[15]

In this exercise, Total Revenue is therefore modelled as follows:

Total Revenue = (Revenue from Operations) + (Non-operating Revenues)
Revenue from Operations = (Way-bill Revenue) + (Other operating Revenues)
*Way-bill Revenue per year = (Fare/km) * (Passenger-km transported / year)*
Passenger-km/Year = (No. of Buses Operated/day)(Carrying capacity/bus)*AVU*LF*365*

Costs, on the other hand, were examined in their sub-components, such as Fixed Costs and Variable Costs. The main component of Fixed Costs would consist of emoluments of personnel, while bank interest and depreciation of fixed assets, also were taken into account in this analysis.[16] Variable Cost items would include fuel, tires and tubes, spare parts for regular maintenance, ticketing, and other inputs demanded as a function of operations. Cost-effectiveness, in this case, would reflect the minimum necessity of inputs for a given transport service supply, or maximum service supply produced using a given set of input, or both. Figure 2 depicts the conceptual framework developed for performance diagnostics used in the present research, in which, the overall financial

---

[12] Non-operating Revenues may include revenues earned from advertising, leasing of properties, scrap sales, bank interest, as well as Treasury grants and subsidies.

[13] "Subsidies" not attributed to any welfare service provided by the SLTB are excluded from the analysis.

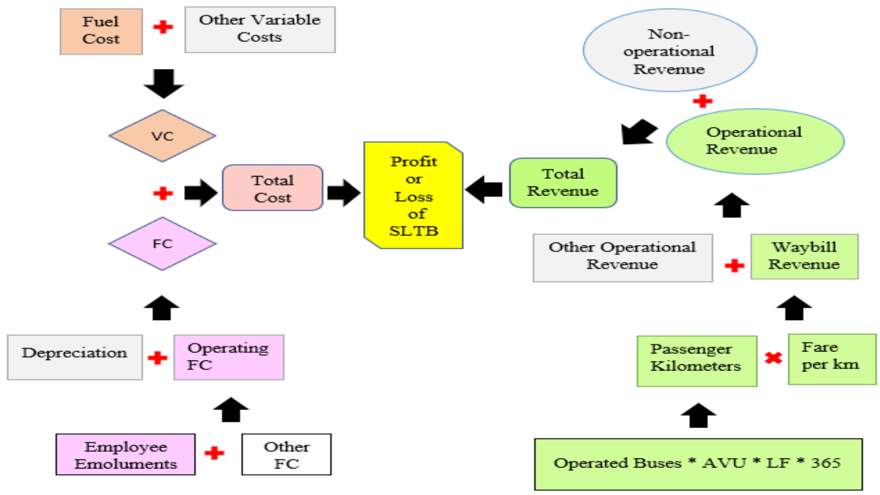
[14] AVU is defined as the average number of kilometers run per operated bus on an average day. This is an indicator of the level of service provision by an operated bus, on average. It is noteworthy here that the SLTB, though being labelled as an inefficient State-owned establishment is significantly ahead in regard to this performance indicator with its average AVU of over 200 kilometers per bus per day, compared to privately owned operations merely averaging less than 150 kilometers per bus per day.

[15] Load Factor (LF) indicates the average occupancy level, expressed as LF=Passenger km/Seat km

[16] Depreciation and interest on long-term loans also were included in the analysis under Fixed Costs, to apprehend the evolution of the organizational capability of SLTB to reach "overall viability", going beyond examining mere "operating performance".

performance of SLTB is modelled as the combined result of the two dimensions of productivity; namely, the revenue-generating efficiency and the cost-effectiveness in service provision.

Figure 2: Conceptual Framework for the Analysis



Source: Author Developed

The investigation focused on the period between 2009 and 2017, for which data required were sourced from various reports produced by the SLTB, mainly focusing on operating statistics. Profit and Loss statements and "O-51" reports of SLTB were used as main sources of data; which were gathered in aggregation for the entire organization, as well as in disaggregation for regions (12 of those) and individual bus depots (108 in the entire country), wherever necessary and appropriate. Access to financial and operational statistics of the SLTB was facilitated through its computerized ERP database system. Annual Reports of the Central Bank of Sri Lanka, fuel price reports sourced from the Ceylon Petroleum Corporation, and statistics published by the National Transport Commission were used as supporting data and information. The levels and trends of cost and revenue performance indicators were analysed and compared, using descriptive statistics.

Ordinary Least Square (OLS) estimation was deployed to examine depot-wise fuel efficiency levels and their possible determinants. The results were analysed and interpreted to derive logical and appropriate inferences concerning the evolution of SLTB's performance and possible factors behind the turn-around observed in 2017, and also throwing light as to the scope of further improvement and to strategic steps, the management and policymakers could take towards such a goal.

ANALYSIS RESULTS AND DISCUSSION

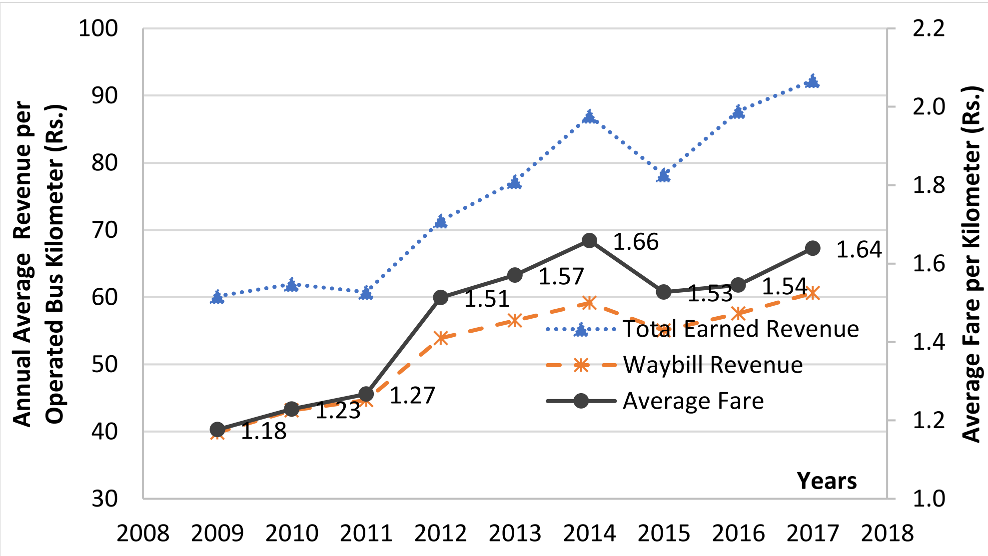
Analysis of performance was conducted as per the conceptual model depicted in Figure 2 above. Diagnostics on revenue-generating capacity were made under AVU analysis and Load Factor assessment, combined with the evolution of the Government-authorized Fare-per-kilometre level. The focus of Cost performance was on variable and fixed cost items, and their trends.

Revenue diagnostics

SLTB's average revenue per kilometre evolved favourably over the years. Yet, the entirety of this favourable trend could not be attributed to managerial effort, as the fare level allowed, an important factor behind revenue, is exogenously determined (regulated by the Government), and hence, does not fall within the decision-making control of SLTB's management.

Figure 3 demonstrates how bus fare level and revenues generated per operated bus kilometre comparatively evolved over the period from 2009 to 2017. It is noteworthy that both the Revenue curves, particularly that of the Way-bill revenue, has closely followed the evolution of bus fare level.[17]

Figure 3: Trends of Revenues generated by the SLTB 2009-2017



Source: Sri Lanka Transport Board (Way-bill Revenue data were sourced from Profit and Loss Statements, while Fare levels were extracted from O-51 Report).

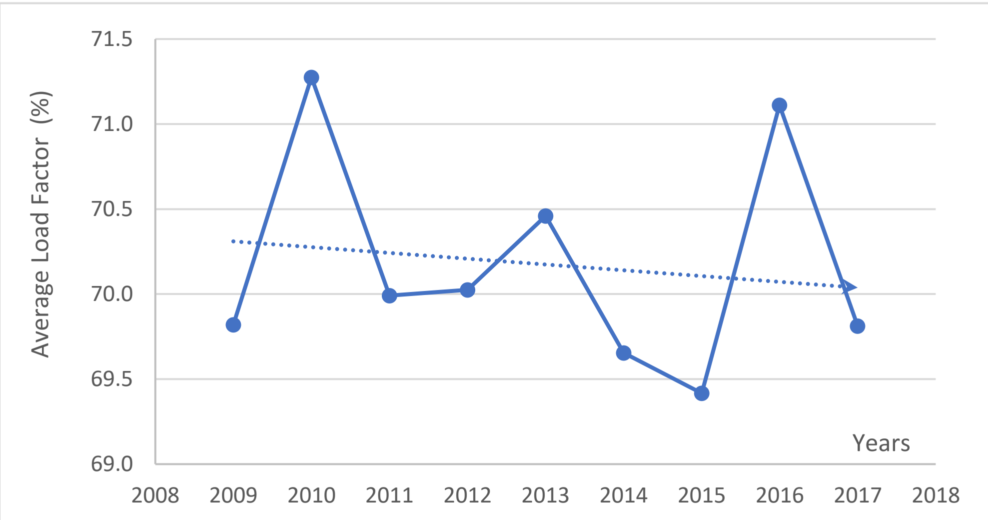
[17] The gap between the two revenue curves has remained somewhat stable indicating that "other earned revenues" have not been that influential over the pattern of evolution of total revenues earned, except for the relative shrink observed in 2011 and 2012, and the slow expansion visible thereafter.

A significant inference that could be made, therefore, is that the waybill revenue improvement recorded after 2015 could have been driven by the fare level augmentation of approximately 7% between the two years. It may be noted here that the fare level in 2017 was the second-highest recorded since 2009, and it should have contributed significantly towards achieving the higher waybill revenue recorded in that year and earning profits.

This enables constructing the hypothesis that the SLTB's management has not been successful in securing any augmentation of revenue passenger kilometres per operated bus kilometre over the years; failure to reduce revenue leakages, including ticket-less travel and other malpractices, and also to significantly augment Load Factors, might have been the causes behind.

The Load Factors (LF) depicted in Figure 4 substantiates the above-raised hypothesis that the SLTB during the 2009-2017 period has been unable to improve her Load Factors.[18] In effect, a significant drop is visible in 2017 compared to 2010 and 2016. This demonstrates that SLTB has failed in attracting passengers to patronage seat-kilometres it offered in 2017. Therefore, the causality of LF as a determinant in bringing about the exceptional financial result in 2017 could not be established, even though it could have been a factor contributing to revenue performance improvement in 2016 compared to 2015.

Figure 4: Trends of the Average Load Factor

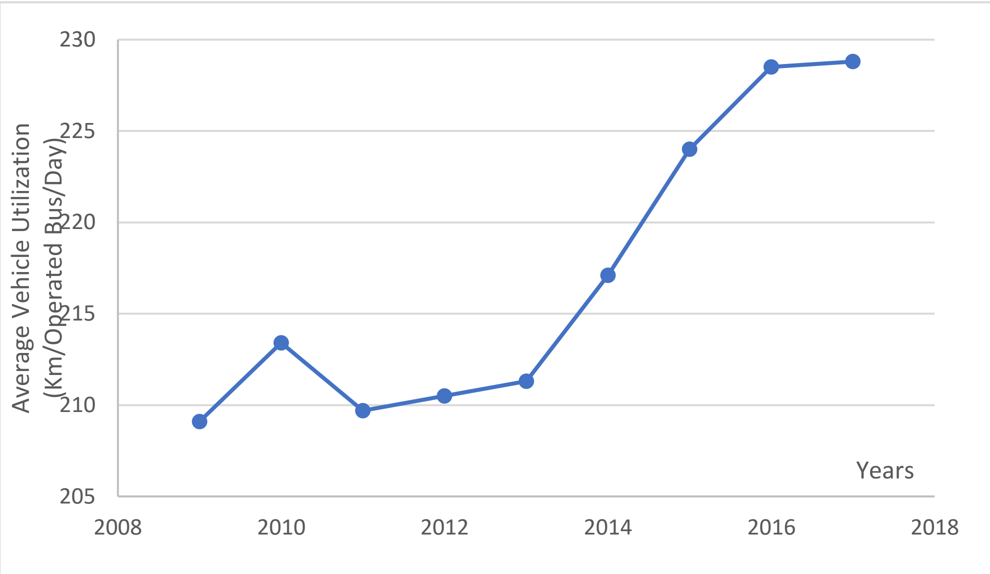


Source: O-51 Reports of the SLTB

[18] Reduced Load Factors could, however, indicate reduced passenger congestion in buses, a favourable parameter in terms of quality of travel.

The total revenue earned in operation is driven by yet another parameter, namely the Average Vehicle Utilization (AVU). This reflects the distance (in kilometres) operated on average per day by a bus deployed for service. According to Figure 5, the AVU of the SLTB has undergone a visible improvement from 2012 up to 2016,[19] which could well be a reason behind the favourable evolution in total revenues and profits reported after 2015. Yet, it is noteworthy that the same AVU level in 2017 was also recorded in 2016, and thus, AVU could not be inferred as a determinant variable behind the exceptional financial profitability recorded in 2017, the particular observation researched under this study.

Figure 5: Trends of the Average Vehicle Utilization



Source: O-51 Reports of the SLTB

Based on the above analytical observations, it could be inferred that the revenue-side push has effectively contributed towards improvement in financial performance of the SLTB after 2015. Management, having succeeded in improving the operability of the bus fleet to supply more seat-kilometres (through increased AVU) could be credited for improved revenue performance in 2016; but the analysis could not produce any evidence to infer that the exceptional performance in profits recorded in 2017 could be attributable to any managerial action.

---

19 This, again, could not be attributed to a significant productivity enhancement in technical and operating wings of the SLTB, because there appear to be a substantial augmentation of the running bus fleet, from 5083 in 2013 to 6424 in 2015, approximately 25% increase over a period of 2 years, possibly reflecting a substantial injection of capital by the Government, in terms of new or rehabilitated buses (This aspect needs deeper examination in a separate study).

The study examined the potential revenue foregone in 2017 because of managerial failure to maintain the Load Factor levels at previously recorded high levels. For instance, SLTB could have earned more revenues had it managed in 2017 to secure the same Load Factors as in 2016, for instance, together with the higher fare level accorded by the Government in 2017, and with the same AVU recorded; the results are summarized in Table 1.

Table 1. Potential Waybill Revenue Earning for 2017

Load Factor realized in 2017	69.81%
Load Factor achieved in 2016	71.11%
Additional Passenger km that could have been transported in 2017 if the same LF of 2016 was achieved in 2017	291.66 Mn
Additional Way-bill Revenue that could have been earned from that additional Passenger km at the fare level of Rs 1.64 per km in 2017	Rs 478 Mn

Assumption: All additional passenger-kilometres transported would earn revenues at the average fare level, without any revenue losses.

Source: Author's Estimates, using data sourced from the SLTB

It can, therefore, be concluded that SLTB has foregone realizing nearly half a billion Sri Lankan rupees of potentially earnable revenue owing to its inability to maintain its Load Factor level. The reasons for this apparent weakness in bus operations could be many, including management lapses, heavy and unruly competition on the road given by the private bus operators.[20]

Analysis of Cost-Effectiveness

As depicted in the Conceptual Framework in Figure 2, the cost is the main determinant in the profit function. There are two main categories of costs that figure in the Profit and Loss Statement of the SLTB; namely, the Fixed Cost (FC) and Variable Cost (VC). Variable cost in bus transportation represents those cost items that vary depending on the level of operated bus kilometres. Fixed Costs are direct or indirect costs and overheads that do not depend on the number of bus kilometres operated, and are presented either including or excluding depreciation.[21] The present study analysed Variable costs per operated bus kilometre and annual average fixed cost excluding depreciation per operated

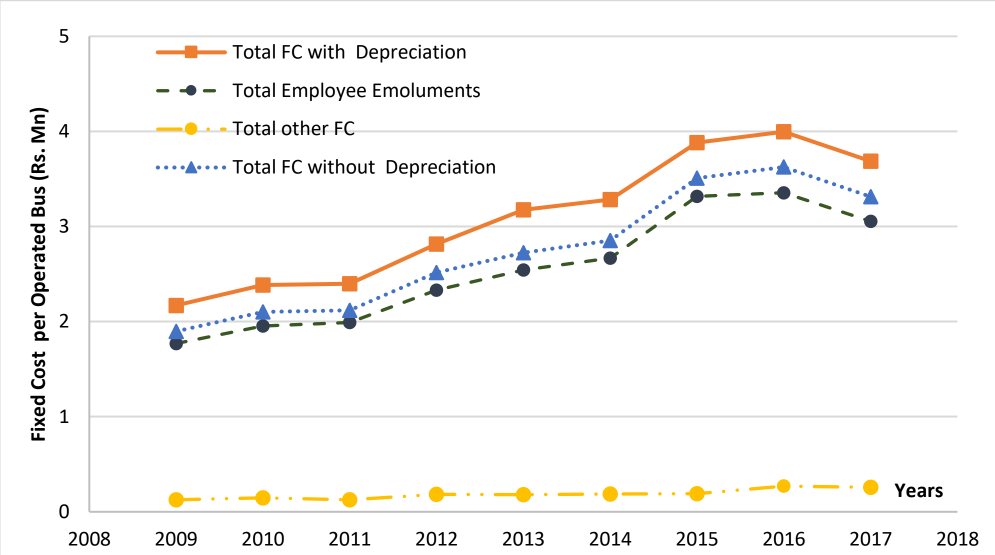
[20] Identification of causes could be pursued in a future study focusing on this aspect.

[21] Only those "operating Fixed Costs" (excluding Depreciation) are considered when estimating "Operating Profits/(Losses). Depreciation is deducted from Operating Profits to arrive at Net Profits.

bus, in view of estimating "Operating Profits/(Losses)", and depreciation was deducted from that to arrive at Net Profit / (Loss) after Depreciation (depicted in Figure 1).

Operating fixed cost is composed of two components, namely (a) total employee emoluments and (b) other fixed costs, the evolution of which in SLTB operations is depicted in Figure 6.

Figure 6: Evolution Fixed Cost per Operated Bus



Source: Sri Lanka Transport Board

It is noteworthy that the total operating fixed cost (excluding depreciation) has persistently increased (except in 2017), and evolved almost parallel to the employee emolument changes.[22] This reflects the overwhelming influence of employee emolument components on the total fixed costs of the SLTB. "Over-staffing" leading to unnecessarily heavy employee emoluments is commonly blamed in literature for the poor financial performance of State-owned organizations (Armstrong-Wright & Thiriez, 1987). In SLTB too, the level of employment was more than 35,547 persons in 2015, representing 7 persons per operated bus, obviously causing heavy emolument related Fixed Costs. The number of employees has dropped to 35,000 by 2016, and to 31,310 by the end of 2017, reducing the number to 6 persons per operated bus.[23]

[22] As evident in Figure 6, there is not much of a difference in the pattern of Fixed Costs including and excluding Depreciation, indicating that the impact of depreciation on Fixed Costs per bus is somewhat stationary over the years.

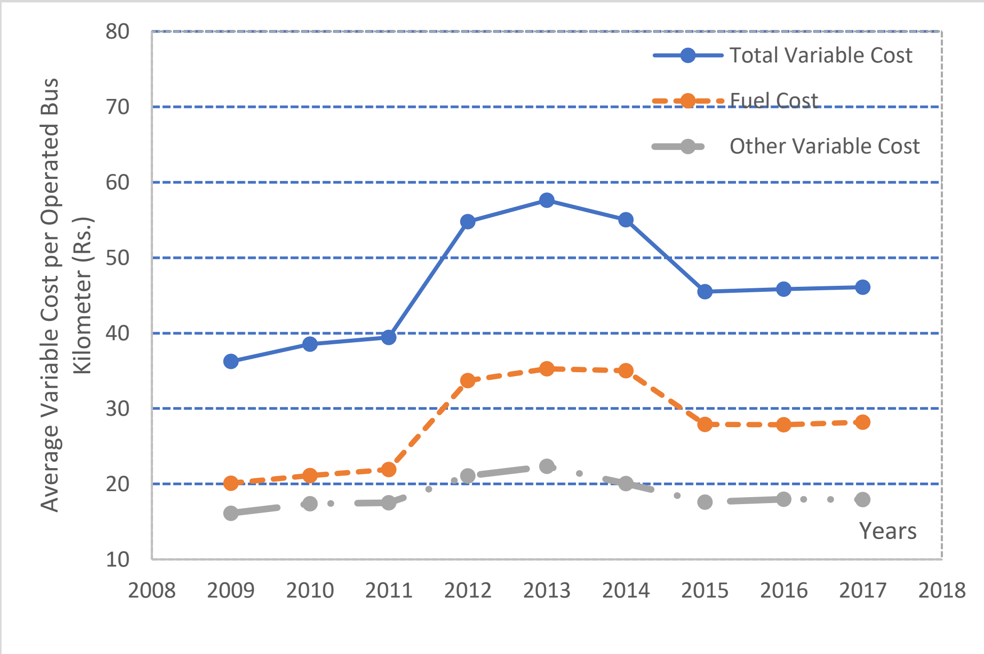
[23] Number of operated buses in 2017 was 5266, leading to this ratio with the effective number of employees of little over 31000 by the end of the year 2017 (Source: from Profit and Loss Statements of corresponding years).

This is owing to the policy decision taken to offer a Voluntary Retirement Scheme (VRS) to SLTB employees implemented in 2016 and 2017, resulting in a significant number of employees retiring during these two years. The reduced growth rate of emolument costs per bus from 2015 to 2016, and the substantial drop by 8% in 2017, is likely to be a direct result of this policy initiative.

The results of the present analysis, therefore, enable inference that the favourable trend observed in the reduction of fixed costs, realized mainly through the VRS introduced, would have been a strong causal factor behind the overall financial improvement recorded after 2016, and particularly in 2017, for which the "policy initiative", more than management effort, could have been instrumental.

The research, as its next step, went into examining Variable Cost (VC) of operations. Figure 7 depicts the evolution of Variable Cost and its components over the years, which does not show any favourable trend, except during the short spell between 2013-2015.

Figure 7. Trends of Variable Cost



Source: Sri Lanka Transport Board

Variable Cost per operated kilometre has continuously increased during the post-2015 period, implying that the improving trend in financial performance, and the overall profitability secured in 2017, cannot be attributable to any variable cost management effort. It is noteworthy also, as depicted in Figure 7, that Total Variable Cost has closely followed the same pattern as Fuel Cost, with a significant peaking at Rs 57.6 per bus km in 2013. The share of Fuel Cost in Total Variable Cost per bus kilometre ranged between the minimum of 54% reported in 2010, and a maximum of 64% in 2014. “Other Variable Costs" figured between Rs 16 to Rs 23 per bus kilometre, with an average of approximately Rs 19 per bus kilometre during the period of analysis.

These indicate that “Other Variable Costs” have not been significantly influential in determining the fluctuations of Total Variable Costs; the maximum upward push given being around Rs 3 per bus km reported in 2013. Thus, the importance of examining Fuel Cost and its determinants to perceive the patterns of evolution of financial profitability of SLTB, and also to explore the scope for further improvements, becomes evident.

Analysis of Fuel Costs, and Operating Performance on Fuel Inputs

Given that the performance on fuel usage figures among important elements of vehicular operating efficiency in any transport business (Korattyswaroopan, 2010), fuel savings would potentially offer significant scope for improved profitability of such organizations. The fuel usage efficacy in SLTB’s bus operations over the period between 2009 and 2017, and particularly in 2017, was thus examined. The rationality of this attempt is reflected by the fact that SLTB has consumed nearly 133 Million litres of diesel for its bus operation in 2017, spending over Rs 12 Billion, representing over 46 % of the Way-bill Revenue earned in the same year. (Sri Lanka Transport Board, 2017)

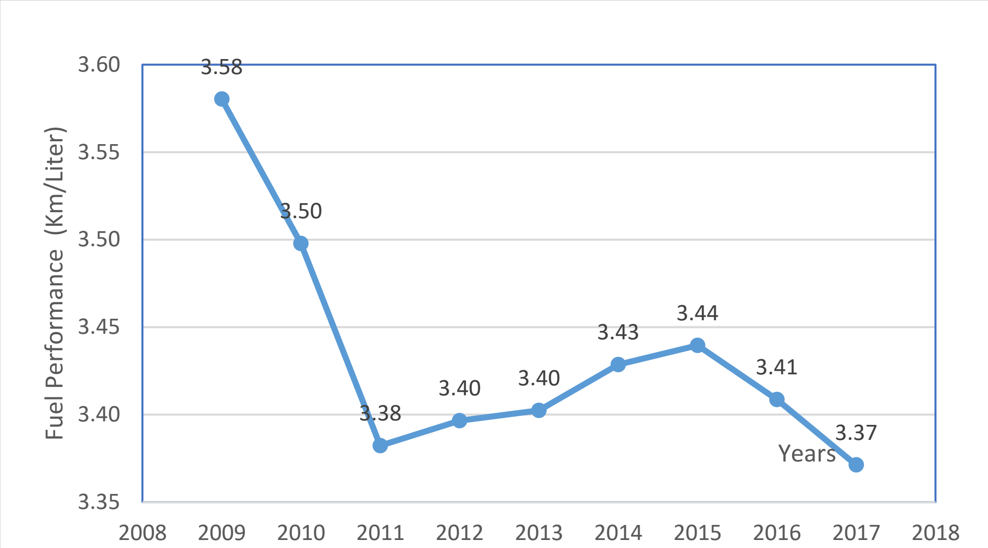
As a departure point, bus kilometres operated per litre of diesel consumed was chosen as the fuel performance indicator (FPI), worked out as follows, using the published data on fuel cost per operated bus kilometre:[24]

$$\text{FPI} = \text{Operated bus km per litre of fuel} = \frac{\text{Price of Fuel per litre}}{\text{Fuel Cost per bus km}}$$

The evolution of this fuel performance indicator over the period from 2009 to 2017 is depicted in Figure 8. It is evident from this analysis that the fuel performance indicator (FPI) has been the highest (3.58 km/litre) in 2009, and the lowest (3.37 km/litre) in 2017. Therefore, it is established beyond any doubt that surplus profits earned in 2017 could in no way be attributed to any improved fuel usage efficiency. On the contrary, it is implicit that the SLTB has foregone possible fuel economics corresponding to 0.21 kilometres per every litre consumed corresponding to nearly a 6% weaker performance on fuel in 2017 compared to 2009.

[24] While Operated Bus kilometers per liter of fuel is defined as the ratio between the total bus kilometers operated divided by the total number of liters of fuel used, the present analysis adopted another way of estimating the same, using the published data on fuel cost (in Rupees) per operated bus kilometer and on the relevant fuel price (in rupees) per liter of fuel; dividing the latter by the former yields bus kilometers operated per liter of fuel.

Figure 8. Kilometres Operated per litre of Fuel Usage



Source: Author's Estimates, using data from SLTB & Ceylon Petroleum Corporation

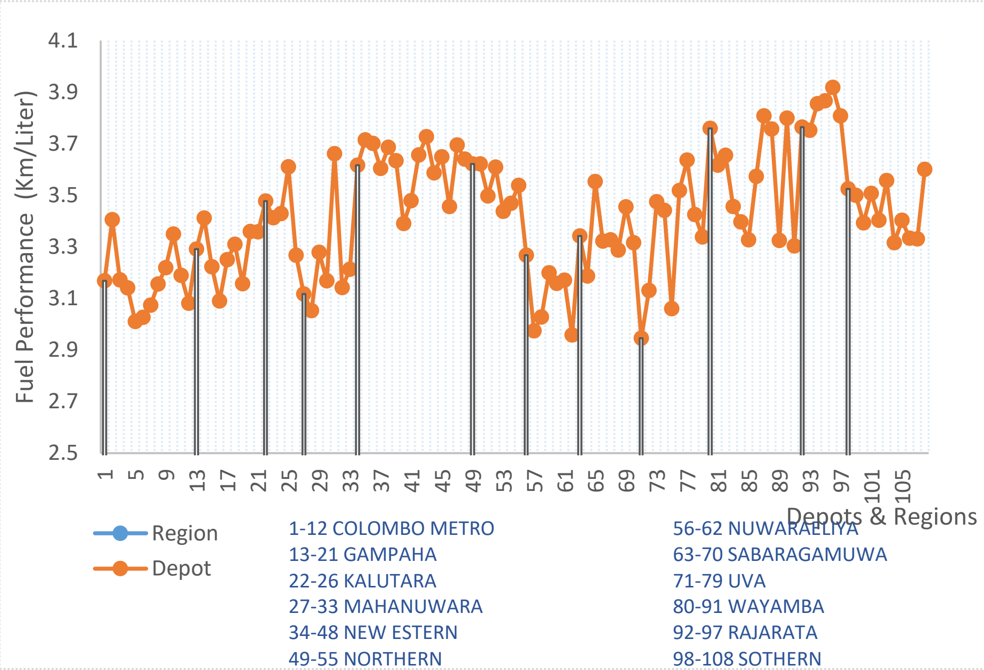
In other words, the organization has failed to secure 1.75 litres of potential fuel savings for each 100 km of bus operations,[25] for not managing to operate buses at the same level of fuel efficiency that prevailed in 2009. This indicates that the SLTB has a foregone possible extra financial surplus of Rs 745 Million, corresponding to 7.8 Million litres of diesel in 2017, simply because it has failed to maintain its overall average annual fuel efficiency level through the past years.

Operating performance on fuel could be influenced by several determinants. According to literature, inefficient driving ability, size and the load of the vehicle, fleet maintenance, the type/make/model of the vehicle, and engine and age of the vehicle are among such contributory variables (Armstrong-Wright & Thiriez, 1987). Geographical terrains, road conditions, and traffic conditions also are considered as fuel efficiency determinants, though such factors are difficult to be quantified and managed by the vehicle operator. The impacts of these factors are not captured when the overall average annual fuel performance indicators (FPIs) are considered.

It is for this reason that the present research was extended to examine depot-wise fuel efficiency levels in 2017 in view of identifying variations among different regions and depots, better reflecting area, or locality specific characteristics. Data on 108 depots belonging to 12 regions, were thereby analysed to perceive such differences.

[25] Fuel consumption difference per every 100 km of operation would amount to [100*(A-B)/AB] liters, where A and B represent kilometers of operation per liter of fuel in the two different years.

Figure 9. Fuel Performance of Depots in 2017



Source: Authors' Estimates, using data sourced from the SLTB

Figure 9 depicts fuel performance levels (km operated per litre) managed in 2017 by individual depots and grouped into regions. It is clear that the performance indicators were relatively weaker corresponding to depots in Colombo Metro, Gampaha, Mahanuwara and Nuwara Eliya regions, and also some depots in the Uva region. Severe traffic congestion may have been a reason behind the low fuel performance efficiency levels observed in Colombo and Gampaha regions, while hilly geographic terrains and curvy roads may have caused such low fuel performance levels in Mahanuwara and Nuwara Eliya regions. Several depots operating urban routes in the Mahanuwara region may have had an adverse impact on their fuel efficiency levels, from both traffic congestion and geographical/road conditions. Several depots in the Uva region, mainly in Badulla district, also were recording low fuel efficiency, most likely because of hilly terrain as well as narrow/curvy roads. Depots in New Eastern, Northern, and Rajarata regions, average fuel performance indicators appear relatively high, probably owing to lesser traffic congestion, and relatively favourable road/even terrain condition.

Having made the above observation, the research was furthered to examine depot-wise fuel performance levels while screening for these two deterrent factors, namely difficult terrain, and traffic congestion, together with the known contributory factor, namely the AVU (Average Vehicle Utilization); longer distance express services, giving rise to high

AVUs, usually consume less fuel per kilometre. Linear regression analysis was used for this purpose. A model, in the following form, was thus tested.[26]

$$FP = f\,(AVU, Congestion, Terrain)$$

In this model, FP (Fuel Performance, in bus kilometres operated per litre of fuel) was regressed against the determinant variables, namely AVU (Average Vehicle Utilization, representing average kilometres operated per bus per day), and the two Dummy Variables, Congestion (0= no congestion, and 1= congestion present) and Terrain (0 = favourable terrain, and 1 = Hilly terrain).[27]

Cross-section data for 108 Depots pertaining to the year 2017 were used in the analysis. Appropriate values for dummy variables were assigned by the researchers based on the urbanized nature and terrain corresponding to the location of each depot. The model was estimated using the Stata software package. The validity of the model was confirmed by the correct direction of the signs of coefficients, t-values indicating their significance, and by perceiving the patterns of squares of the differences between estimates. The absence of the problem of heteroscedasticity was tested and confirmed using the Breusch-Pagan / Cook Weisberg Test.

The estimated model, the coefficients of significant variables, and their respective t-values are as follows (detailed regression statistics and heteroscedasticity test results are provided in the Annexure-A):

FP = 3.032 + 0.002 (AVU) – 0.24 (Congestion) – 0.138 (Terrain)
t- Values (3.951) (-5.449) (-2.824)

F-Value = 37.41 $R^2 = 0.52$ *Adjusted* $R^2 = 0.51$ *Root MSE =0.16*

All variables emerged significant (with high t-values), and their coefficients were found possessing the expected signs. This means that more the average AVU, greater would be the operating performance on fuel, while the inverse would be observed under the conditions of greater traffic congestion and hilly terrains.

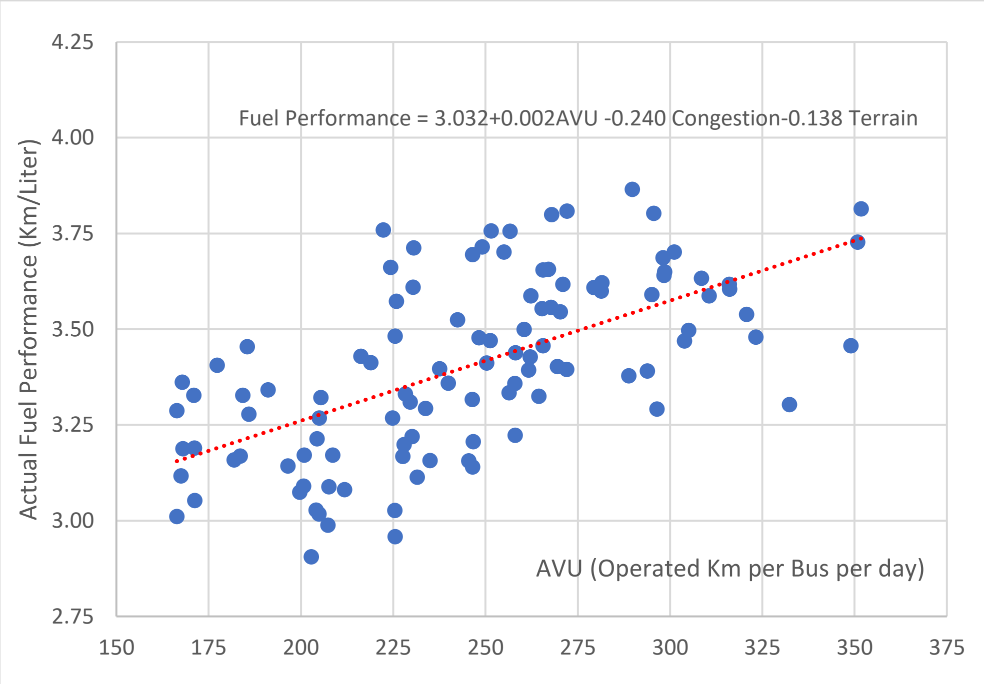
---

[26] A model was run using region-wise average age of the operating bus fleet also included as a determinant, which variable, however, did not emerge as significant. Depot-wise average age of bus fleet could not be fetched from SLTB Head Office. Sourcing such data appeared needing much more intensive data gathering.

[27] The assigning of dummy values were on terrain and traffic conditions as perceived by Authors, based on the township where the individual depots were located. For better accuracy, a route-wise assessment is needed, as buses in depots are operated in different routes which are not always congested and not all the way on difficult terrains.

In an attempt to unearth the degree of "relative inefficiency", the fuel performance values of individual depots were plotted and their positioning in relation to the fitted model represented by the trend line was observed (Figure 10). Those depots positioned above the trend line could be considered more "fuel-efficient" than the average expected performance under given conditions, while those depots figure below the trend line are relatively "fuel-inefficient".

Figure 10: Evolution of Fuel Performance



Source: Author's Estimates, using data sourced from the SLTB

It is noteworthy that nearly 60% of the depots of the SLTB could be classified as "fuel-inefficient", according to the results of this analysis.[28] Therefore, the presence of significant scope for fuel-efficiency improvement through managerial effort could be inferred.

The study used the difference between the average expected fuel performance and the fuel performance realized as the basis for estimating the level of fuel inefficacy, and through which, to estimate the scope for economizing on fuel at depot level. The fuel-saving potential (thus, the extent of foregone fuel economics) in 2017 had the

[28] The "fuel inefficiency" in this case is not "absolute", but "relative" to the average fuel performance threshold represented by the trend line. This does not mean, however, that the trend line itself cannot be shifted upwards, the strategies for which have to be explored through a more refined analysis.

management of those "fuel-inefficient" depots matched the average expected fuel performance level, (details presented in Annexure-B) could be as summarized in Table 2.

Table 2: Potential for Fuel Economics

Description	**Year 2017**
Number of depots performing below the average expected fuel performance level	65 (out of 108), or 60%
The actual amount of fuel consumed in 2017 to provide 237 Mn bus kilometres by those "fuel-inefficient" depots	72.48 Mn Litres
The estimated amount of fuel needed to provide 237 Mn bus kilometres had those depots operated at the average expected fuel performance level in 2017	69.23 Mn Litres
Potential savings of fuel foregone in 2017	3.25 Mn Litres
Additional Financial Surplus that appears to have not been realized because of fuel consumption inefficacy (at 95 Rs/l)	Rs 309.17 Mn (or 24 % of Net Profits earned)

Source: Authors' Estimates

It is evident, according to these estimates, that the SLTB could have saved around 3.25 million litres of fuel if the respective depots managed to operate buses at the "average expected" fuel performance level in 2017 for those to avoid being considered "fuel-inefficient". It amounts to a possible financial saving foregone to the SLTB of over Rs 300 Million in one single year.

This outcome of possible fuel savings, just by matching with the depot-level "average expected fuel performance" recorded in 2017, brings further evidence to support the substantial scope of possible fuel economics that could have been secured by the SLTB had it managed to match the average fuel performance level of 2009. By those "fuel-inefficient" depots meeting the "average performance level" in 2017, the overall average of fuel performance level in that year could be raised so that the fuel performance gap between 2009 and 2017 would be narrowed. Yet, such rectification based on the "averages" of a given year would not necessarily eliminate reasons which would have caused a year-by-year decline of annual averages of fuel performance. Further research is warranted to examine such causes, and to contemplate remedial action by the management as well as by the policy makers.

The overall potential for improved profitability

In summary, the study outcomes enabled several important realizations. First, the improved financial performance recorded by the SLTB after 2015, and the particular occurrence of the organization achieving profits after depreciation in 2017, possibly for the first time in decades, were driven both by revenue enhancements and cost reductions. Second, neither the revenue enhancement nor the cost reduction, during this period could be attributable to SLTB's managerial action. Third, the revenue performance appeared to have been driven by augmented bus fare levels, which is exclusively a policy decision by the Government. Fourth, no significant improvement was visible in attracting passengers as reflected in Load Factor evolution, and in fact, the load factor has dropped significantly in 2017, the year in which the organization reported exceptional profits. Fifth, there has been substantial fixed cost reductions observed in 2016 and 2017, which appeared a result of savings realized in employment emoluments, apparently associated with the policy-driven Voluntary Retirement Scheme implemented from 2016 onwards, and again not attributable to managerial decision. Next, no significant cost economization that could be observed in variable costs; and, most importantly, the fuel performance levels of the organization, a major component of variable costs, have continuously deteriorated over the years, reflecting an inadequate managerial focus on pursuing fuel usage efficiency.

All these observations and realizations have pointed at "potential earnings and savings foregone" by the SLTB over the years, particularly by failing to maintain load factors, on the one hand, and fuel performance, on the other. Table 3 presents a summary of these realizable surpluses forgone.

Table 3: Realizable Surpluses Forgone by the SLTB in 2017

Source of additional profits that could have been realized in 2017	**Amount (Rs. Mn)**
Through maintaining the overall average Load Factor (Compared to the level in 2016)	478
Through sustaining fuel performance level prevailed in 2019	745
Total financial surplus foregone	1,223

Source: Authors' Estimates

For instance, in 2017, the organization's net profits would have been Rs 478 Mn more had it managed to maintain its load factor at previous year's level. Moreover, had the fuel performance level in 2017 stood the same level as in 2009, there would have been in 2017 a supplementary net surplus of Rs 745 million; around Rs 300 million of which could have been realized simply by focusing on apparently "fuel inefficient depots" for those to match their fuel performance levels with the average expected level prevailed 2017. This amount foregone is approximately 3% of SLTB's revenue. If realized, it would have almost doubled the total net profits in 2017, and thus, indicates a substantial leap missed by the organization that year.

CONCLUSIONS AND RECOMMENDATIONS

The outcomes of the study, while confirming that there has effectively been an improvement in the financial performance of the Sri Lankan Transport Board during the post-2015 period, and that the organization has earned net profits after providing for depreciation of Rs 1216 Mn, representing a net margin of 3% on the total revenue "earned" in 2017, also enabled several important revelations. First, the improved financial performance recorded by the SLTB after 2015, and the particular occurrence of the organization achieving profits after depreciation in 2017, possibly for the first time in decades, have been driven both by revenue enhancements and cost reductions. Second, the bus fare augmentation, as determined by the Government, appeared to be the cause behind improved revenue performance, and no significant success could be observed in attracting more passengers to buses. The average Load Factor has dropped significantly in 2017, the year in which the organization reported exceptional profits, further reinforcing the hypothesis that the SLTB's managerial action has not been a significant driver of improved revenue performance of SLTB during the post-2015 period.

Third, there has been a substantial fixed cost reduction observed in 2016 and 2017, which appeared a result of reduced employment emoluments, apparently associated with the policy-driven Voluntary Retirement Scheme (VRS) implemented from 2015 onwards, and again not attributable to a factor within the control of the SLTB's management. Fourth, no significant reduction could be observed in variable costs. Fuel performance levels of the organization, for instance, have continuously deteriorated over the years, reflecting an inadequate managerial focus on pursuing fuel usage efficiency. In summary, the study outcomes enabled conclusion that the improved financial performance recorded by the SLTB after 2015, and particularly the net profits earned in 2017, could not be attributed to the management of factors by the Board of the SLTB, but to decisions taken by the Government at the policy level, which are exogenous to SLTB's management.

However, these observations and realizations have pointed at one important inference; that is, the SLTB still offers substantial room for productivity improvement. This is mirrored also by the fact that the organization has forgone substantial amounts of potential earnings and savings over the years, particularly by failing to maintain load factors, on the one hand, and fuel performance, on the other. This raised concerns as to the loss of possible economics to public coffers in terms of both budgetary finance and unnecessarily heavy burden on foreign exchange on oil, and also to the risk of not being able to sustain the positive financial performance realized in 2017. It also has externality concerns in terms of unnecessarily high air pollution, caused by failing to realize possible efficiency levels in fuel use. It is noteworthy that 3.25 million litres a year of possible savings foregone in diesel consumption would amount to 2340 tons of carbon emissions, or over 8580 tons of Carbon Dioxide emissions, unnecessarily discharged every year to the environment,[29] implying substantial social benefit in respect of pollution abatement that has been foregone in 2017 alone.

It is therefore recommended that the management of the SLTB pay closer attention to examine in detail its financial accounting headings and subheadings, and their operational and engineering technicalities by way of furthered research, in view of identifying scope for improvement and strategizing towards greater efficiency in view of realizing better institutional economics. Fuel efficiency, revenue collection performance, human resource deployment efficacy, and the capacity to attract passengers, examined in more details through route-wise performance indicators, may be a candidate domain for such future research.

REFERENCES

Abreha, D. A. (2007). Analysing Public Transport Performance Using Efficiency Measures and Spatial Analysis: The Case of Addis Ababa, Ethiopia. Netherlands: International Institute for GEO-Information SCience and Earch Observation.

Agarwal, P. K., & Singh, A. P. (2010). Performance Improvement of Urban Bus System: Issues and Solution. International Journal of Engineering Science and Technology, 2(9), 4759-4766.

Armstrong-Wright, A., & Thiriez, S. (1987). Bus Service Reducing Costs, Raising Standards. Washington D.C.: The World Bank.

Badami, M. G., & Haider, M. (2007). An Analysis of public bus transit performance in indian cities. Transportation Research Part A, 41, 961-981.

Berhan, E., Beshah, B., & Kitaw, D. (2013). Performance Analysis on Public Bus Transport of the City of Addis Ababa. International Journal of Computer Information Systems and Industrial Management Applications, 5, 722-728.

Boujelbene, Y., & Derbel , A. (2015). The performance analysis of public transport operators in Tunisia using AHP method. Procedia Computer Science, 73, 498-508.

Gunaruwan, T. L. (2015). Fixed Cost Intensity and Its Implications on the Operational Performance of the Sri Lanka Transport Board, Faculty of Arts International Research Conference (p. 9), Colombo: IConArts.

[29] A liter of Diesel weighs 835 grams. Carbon constitutes 86.2% of Diesel, or a litre of Diesel contains 720 grams of Carbon (http://ecoscore.be/en/info/ecoscore/co2)

Gunaruwan, T. L., & Jayasekara, D. W. (2015). Social inclusivity through public transportation: a strategic approach to improve quality of life in developing countries. Journal of Advanced Transportation, 49, 738-751.

Gwilliams, K., Kumarage, A., & Jayaweera, D. S. (2005). Developing Public Transport in Sri Lanka. doi:10.13140/RG.2.2.33423.79528

How to Calculate the CO2 emission from the fuel consumption? (2020, March 25). Retrieved from ecoscore: http://ecoscore.be/en/info/ecoscore/co2

Jakob, A., Craig, J. L., & Fisher, G. (2006). Transport Cost Analysis: a case study of the total costs of private and public transport in Auckland. Environmental Science and Policy, 9, 55-66

Korattyswaroopam, N. (2010). Improving the Efficiency of Urban Bus Services in India (Doctoral Dissertation, Graduate School-New Brunswick Rutgers, The State University of New Jersey. Retrieved Oct 26, 2019, from https://doi.org/doi:10.7282/T3ZW1KNP

Kumarage, A. S. (1999). An Analytical Review of 40 years of Bus Transport since Nationalization. Engineering Research Symposium, University of Moratuwa. Colombo.

Kumarage, A. S. (2012). Sri Lanka Transport Sector Policy Note. Colombo: World Bank, Sri Lanka.

Matsuo, M. (2015). Efficiency, Effectiveness and Management Characteristics of Rural Local Bus Services in the U.S. Japan: Waseda Institute for Advanced Study.

Ministry of Transport and Civil Aviation. (2018). Performance Report 2017. Colombo: Ministry of Transport and Civil Aviation.

National Transport Commission. (2015). National Transport Statistics 2015. Colombo: National Transport Commission.

National Transport Commission. (2017). National Transport Statistics 2017. Colombo: National Transport Commission.

Olafsdottir, A. (2012). Bus Service Performance Analysis case study: Bus line 1 in Stockholm: Sweden. Sweden.

Pojani, D., & Stead, D. (2015). Sustainable Urban Transport in the Developing World: Beyond Megacities. Sustainability, 7, 7784-7805.

Rohani, M. M., Wijeyesekera, D. C., & Karim, A. T. (2013). Bus Operation Quality Service and The Role of Bus Provider and Driver. Malaysian Technical Universities Conference on Engineering & Technology 2012 (pp. 167-178). Malaysia: Elsevier Ltd.

Sri Lanka Transport Board. (2011). Annual Report 2011.

Sri Lanka Transport Board. (2017). Profit/Loss Statement 2017. Colombo: Sri Lanka Transport Board.

APPENDIX A

Regression Model fitted and corresponding statistics

Model: *FP = 3.032 + 0.002 (AVU) – 0.24 (Congestion) – 0.138 (Terrain)*

```
. reg FUELEFFCIENCYAFE AVU Congestion Terrain

      Source |       SS       df       MS              Number of obs =     108
-------------+------------------------------           F(  3,   104) =   37.41
       Model |  2.95105316     3  .983684388           Prob > F      =  0.0000
    Residual |   2.7348098   104  .026296248           R-squared     =  0.5190
-------------+------------------------------           Adj R-squared =  0.5051
       Total |  5.68586296   107  .053138906           Root MSE      =  .16216

------------------------------------------------------------------------------
FUELEFFCIE~E |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         AVU |   .0018312   .0004623     3.96   0.000     .0009144     .002748
  Congestion |  -.2397632   .0438913    -5.46   0.000    -.3268012   -.1527252
     Terrain |  -.1376664   .0487189    -2.83   0.006    -.2342778   -.0410549
       _cons |   3.033464   .1258582    24.10   0.000     2.783883    3.283046
------------------------------------------------------------------------------

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of FUELEFFCIENCYAFE

         chi2(1)      =     0.19
         Prob > chi2  =   0.6656
```

Source: Authors' Estimate

APPENDIX B

Depot-wise Estimation of Fuel Inefficacy in 2017 and Saving Potential

Depot	Δ (FE)[1]	Possible fuel saving (l/km)	Total Operated km (Mn)	Possible fuel savings (Mn litres)
Homagama	-0.020	0.002	4.358	0.010
Katubedda	-0.380	0.035	1.896	0.066
Kesbewa	-0.110	0.012	3.143	0.038
Maharagama	-0.220	0.022	5.760	0.127
Mattakkuliya	-0.120	0.012	3.283	0.039
meethotamulla	-0.130	0.012	2.879	0.035
Moratuwa	-0.030	0.003	3.413	0.011
Ratmalana	-0.140	0.014	2.999	0.042
Udahamulla	-0.130	0.014	3.960	0.054
Devlapitiya	-0.090	0.008	4.219	0.035
Ja Ela	-0.090	0.008	2.633	0.021
Kadawatha	-0.100	0.010	3.047	0.032
Kelaniya	-0.080	0.008	2.835	0.021
Negambo	-0.110	0.010	3.317	0.034
Alutgama	-0.050	0.004	3.624	0.015
Horana	-0.060	0.005	3.649	0.018
Kalutara	-0.040	0.003	3.460	0.010
Teldeniya	-0.180	0.017	3.399	0.058
Waththegama	-0.140	0.014	2.857	0.040
Yatinuwara	-0.090	0.008	4.711	0.040
Akkareipattu	-0.050	0.004	2.585	0.009
Eravur	-0.060	0.005	2.077	0.009
Kalmunai	-0.020	0.001	2.711	0.003
Kanthankudi	-0.230	0.019	1.502	0.028
Kinniya	-0.200	0.016	1.007	0.016
Pothuwil	-0.010	0.000	1.024	0.000
Rethithana	-0.070	0.005	0.969	0.005
Trincomalee	-0.270	0.021	3.491	0.074
Karainagar	-0.030	0.002	2.601	0.006
Kilinochchi	-0.150	0.011	2.319	0.026
Mulathiv	-0.110	0.009	1.803	0.016
Point Pedro	-0.170	0.014	4.020	0.054
Vavnia	-0.140	0.010	4.035	0.042
Gampola	-0.040	0.003	3.944	0.013
Haguranketha	-0.320	0.032	2.540	0.082
Hatton	-0.270	0.027	6.282	0.173

Depot	Δ (FE)[1]	Possible fuel saving (l/km)	Total Operated km (Mn)	Possible fuel savings (Mn litres)
Kothmale	-0.150	0.014	2.794	0.039
Nawalapitiya	-0.100	0.010	4.399	0.042
Nuwaraeliya	-0.140	0.013	3.624	0.048
Walapane	-0.390	0.039	2.957	0.116
Deraniyagala	-0.040	0.004	3.683	0.015
Embilipitiya	-0.010	0.001	5.237	0.004
Godakawela	-0.120	0.011	2.936	0.031
Bandarawela	-0.390	0.041	7.253	0.298
Badulla	-0.220	0.022	7.959	0.172
Bibila	-0.130	0.011	4.504	0.048
Dehiattakandiya	-0.180	0.015	2.70	0.0403
Keppetipola	-0.420	0.041	7.18	0.2931
Mahiyanganaya	-0.060	0.005	4.12	0.0217
Thanamalwila	-0.230	0.019	1.82	0.0346
Wellawaya	-0.210	0.018	4.83	0.0864
Giriulla	-0.110	0.009	3.29	0.0285
Kuliyapitiya	-0.110	0.009	5.16	0.0480
Kurunegala S	-0.070	0.007	6.25	0.0407
Puttalam	-0.240	0.02	5.31	0.1059
Wennappuwa	-0.390	0.032	4.06	0.1309
Udugama	-0.050	0.004	2.94	0.0127
Akuressa	-0.160	0.013	3.82	0.0514
Ambalanthota	-0.170	0.014	4.99	0.0691
Elpitiya	-0.010	0.001	3.88	0.0032
Hakmana	-0.210	0.018	3.20	0.0571
Koggala	-0.210	0.018	2.24	0.0400
Matara	-0.160	0.014	4.22	0.0574
Ambalangoda	0.000	0	3.23	0.0003
Kataragama	-0.030	0.002	6.41	0.0141
Total Possible Fuel Saving Liters in 2017				**3.25**
Total Financial Saving in 2017 (Rs. Mn)[2]				**309.17**

[1] Δ(FE) : Differnce between AFE and EFE
Where AFE - Actual Fuel Efficiency
EFE - Estimated Fuel Efficiency

[2] Diesel price per liter in 2017 – Rs. 95.00

Source: Authors' Estimates