



Research Article / Araştırma Makalesi

DEVELOPING OPTIMUM KPI SYSTEM FOR PUBLIC TRANSPORT ORGANISATIONS

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ABSTRACT

In order for public transport organizations to move forward and to quantify effects occurring as a result of changes in strategic objectives, policies, decisions or lines of action, it is imperative to assess their performance. Key performance indicators (KPI) provide quick, adequate and reliable barometers assisting decision makers in identifying success stories, lessons learnt as well as problems and potentials, selecting courses of action, monitoring improvements, and evaluating results. Accordingly, choosing the right mix of KPIs relies upon a good understanding of what is important to an organization. Various frameworks can be employed to categorise and select required set of KPI. In this paper 3 frameworks are utilised to ensure an optimum categorization, selection and development of a KPI system for a public transport organisation. These are balanced scorecard framework, sustainability framework and input output analysis. The research employs the 4 perspectives of balanced scorecard (BSC) namely financial, customer, internal and learn and growth. Furthermore each of these and in a similar fashion is divided into another 4 sub perspectives of balanced scorecard ensuring coverage of 16 dimensions including public transport sustainability dimensions. Finally, input output analysis is conducted where four types of resources are required as input to a public transport organisation namely financial, staff, time, and physical (fleet & assets). The management of a public transport organisation is responsible to utilize these resources through operation of fleet, hence providing passenger transport services & financial outputs. Produced service outputs once used become consumed service outputs. These include: carried passengers, passenger.kilomtres & passenger hours. As a result of utilization of produced service, financial output is generated as operational revenue obtained through fare collection.

Keywords: KPI, public transport, sustainability.

1. INTRODUCTION

Public transport organisations are known to be very complex in terms of diversity of activities and functions. Activities may include provision of bus, metro, tram, inland waterway and metro transport services. While functions usually include planning, procurement, operations, maintenance, contracts, investment, customer services, ITS, driver affairs, franchise and decommissioning. Planners, decision makers, auditors and regulators of public transport organizations all need quick and easy to use tools to monitor and assess performance of such organisations and to eventually assist them to exercise their roles in planning, decision making, auditing and regulating. This is meant to identify success stories to be complemented and

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replicated as lessons learnt as well as to identify issues and problems needing to be avoided/overcome. KPIs continue to be used by many public transport organisations to provide an easy to use, flexible and revealing tool to achieve the above, see Figure 1.

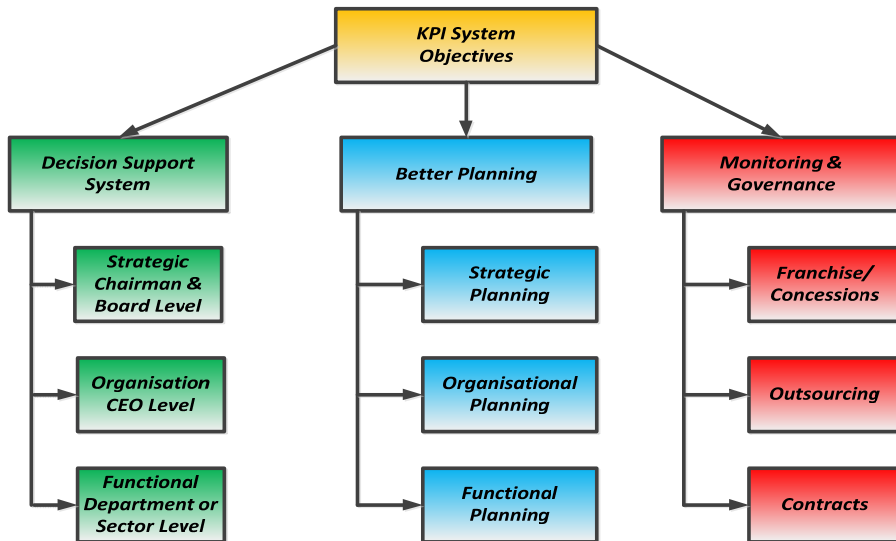


Figure 1. Main Objectives of KPI System in Public Transport Organisations

In general, and as adapted from [1] KPI are used to:

- measure, assess and monitor all aspects of performance of public transport services so that strengths, weaknesses, opportunities and threats are identified and acted upon.
- provide a platform for instigating better future planning of public transport services.
- provide an agreed medium for reporting, communication and evaluation to be used by levels of management for accountability, auditing and regulation purposes.
- provide a tool for governance (gaining insight and judgment).
- quantify the effects that might occur as a result of changes in strategic objectives, policies, decisions or lines of action of a public transport organisation.
- Assist organisations offering loans or grants to assess the performance of a public transport organisations requesting financial assistance.

2. ISSUES OF KPI SYSTEM IN PUBLIC TRANSPORT ORGANISATIONS

Many public transport organisations are facing a number of issues and limitations in the utilization of performance indicators – Such issues and limitations include the following:

- Selected KPIs do not separate key activities of the organisation i.e. for example KPIs cover bus and metro transport activities together rather than separately
- Selected KPIs do not cover all functions of public transport organisations i.e. for example these cover operation & maintenance while functions such as contracting, investment, customer services, ITS, driver affairs, franchise & decommissioning may not be covered.
- The number of KPIs may be too much causing confusion and hence wasting much effort in measurement, data entry, analysis and reporting
- Number of KPIs may not be sufficient to assist planners, decision makers, auditors and

governance agencies in their roles.

- KPIs are not timely reported i.e. they are not reported at the right times to make informative decisions and to better plan, alternatively may be reported excessively causing confusion and lack of concentration.

- Most indicators are absolute values rather than being relative indicators – This do not normalize comparative analysis with other peer or competitive organisations Performance indicators can be presented as absolute and/or relative values. Relative performance indicators are of great importance. These can be best used in comparison and evaluation.

- No benchmarking exists and comparisons are self generated via self target settings.

Hence it is imperative that experts and managers spend time in brainstorming and thinking of the most efficient ways to present the performance of their public transport organisations. For example the management of a public transport organisation should decide in collaboration with the board of directors on the important performance measures that should be included in the board and when these are reported. These should include performance measures that are meant to guide the managers of these organisations to steer their organisations safely towards reaching more stable grounds and conditions that can encourage and instigate profit making with significant improvement in levels of service and hence customer satisfaction or rather customer happiness as in some cities. In the next sections of this paper a generic methodology is suggested that can assist in the optimum selection of the 3 Rs i.e. right mix of KPI, right type of KPI as well as right reporting times.

3. GENERIC METHODOLOGY FOR DEVELOPING AN OPTIMUM KPI SYSTEM

Accordingly, choosing the right mix and right type of KPIs relies upon a good understanding of what is important to the organization. In this paper a generic methodology is suggested as displayed in Figure 2 where the starting point is to review best practices in KPI categorisation & identification. Towards this end the paper identified 3 main frameworks; addressed in the next sections. These are employed to categorise and select the required set of KPIs. These are:

1. the management framework known as balanced scorecard,
2. the sustainability framework,
3. the input output framework

Furthermore the research suggests utilising these 3 frameworks in a hybrid fashion to ensure optimum categorization, selection and development of a KPI system for a public transport organisation. This will result into identification of KPI reporting levels as well as KPI categories and types. On the other hand the figure shows that a parallel exercise should be conducted where a review of current KPI system in the case study public transport organisation is conducted. This will result in obtaining the current KPI reporting levels, categories and types of KPI as utilized within the case study public transport organisation.

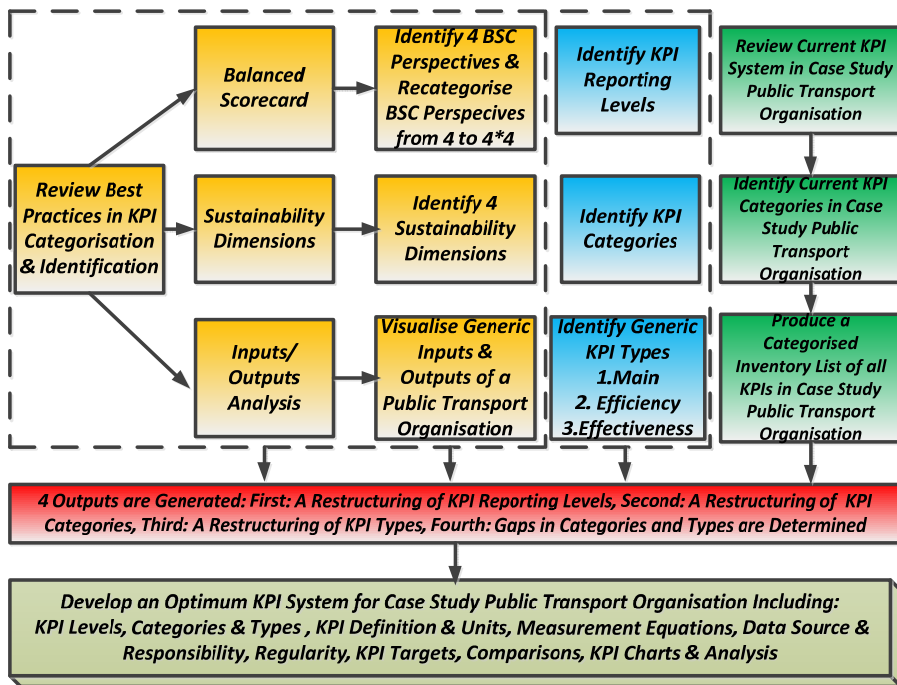


Figure 2. Developing an Optimum KPI System in Public Transport Organisations

Based on the above 4 outputs are generated:

- First:** A restructuring of KPI reporting levels,
- Second:** A restructuring of KPI Categories,
- Third:** A restructuring of KPI types
- Fourth:** Gaps in categories and types are determined

Finally, an optimum KPI system for a public transport organisation is developed including:

- KPI Levels
- KPI Categories
- KPI Types
- KPI Definition & Units
- KPI Measurement Equations
- KPI Data Source & Responsibility
- KPI Regularity
- KPI Targets
- KPI Comparisons
- KPI Charts & Analysis

4. BSC PERFORMANCE MANAGEMENT FRAMEWORK

Every organization, regardless of type, needs a clear and cohesive performance measurement framework that is understood by all levels of the organization and that supports objectives and the collection of results. Performance measurement systems must provide intelligence for decision makers, not just compile data. Performance measures should provide timely, relevant, and concise information for use by decision makers—at all levels—to assess progress toward achieving predetermined goals. The BSC approach to performance measurement and management is currently in use by many “world class” private corporations. The balanced scorecard is a conceptual framework for translating an organization’s strategic objectives into a set of

performance indicators distributed among four perspectives: Financial, Customer, Internal Business Processes, and Learning & Growth, see [3]. Through the balanced scorecard, an organization monitors both its current performance (finance, customer satisfaction, and business process results) and its efforts to improve processes, motivate and educate employees, and enhance information systems—its ability to learn and improve. This research first employs the 4 perspectives of the balanced scorecard, namely the financial, customer, internal business process and learning & growth. The research further categorises each one of these four perspectives into another 4 Balanced Score sub-perspectives (i.e. $4 \times 4 = 16$) and as depicted in Figure 3 and table 1. These are meant to better represent many organisations but more specifically a typical public transport organisation.

FINANCIAL		CUSTOMER	
<i>Investment</i>	<i>Cost</i>	<i>Complaints/Claims</i>	<i>Satisfaction/Happiness</i>
<i>Profit/Subsidy</i>	<i>Revenue</i>	<i>Violations/Fines</i>	<i>Suggestions</i>
KPI Categories (4*4 Balance Score Card)			
LEARNING & GROWTH		INTERNAL BUSINESS PROCESS	
<i>Education/Training/Knowledge Transfer</i>	<i>Research/Innovation/Initiatives</i>	<i>Technical</i>	<i>Social/Distributional/Equity</i>
<i>Rewards/Recognitions</i>	<i>Empowerment</i>	<i>Environment/Ecology/Energy</i>	<i>Safety/Security</i>

Figure 3. BSC Adapted from 4 to 4*4 to Better Represent Public Transport Organisations

Table 1. BSC 4 Perspectives & 16 Sub-Perspectives to Better Represent Public Transport Organisations

Main 4 Perspectives of BSC	Balanced Score sub-perspectives (4*4= 16)
Financial	<ul style="list-style-type: none"> ▪ <i>Investment</i> ▪ <i>Cost</i> ▪ <i>Revenue</i> ▪ <i>Profit/Subsidy</i>
Customer	<ul style="list-style-type: none"> ▪ <i>Complaints/Claims</i> ▪ <i>Satisfaction/Happiness</i> ▪ <i>Suggestions/Violations/Fines</i>
Internal Business Process	<ul style="list-style-type: none"> ▪ <i>Technical</i> ▪ <i>Social/Distributional/Equity</i> ▪ <i>Safety/Security</i> ▪ <i>Environment/Ecology/Energy</i>
Learning & Growth	<ul style="list-style-type: none"> ▪ <i>Education/Training/Knowledge Transfer</i> ▪ <i>Research/Innovation/Initiatives</i> ▪ <i>Empowerment</i> ▪ <i>Rewards/Recognitions</i>

It has to be noted that the internal business process perspective takes into consideration 3 of the 4 dimensions of sustainable public transport systems see Figure 4 including:

- Social/Distributional/Equity
- Safety/Security
- Environment/Ecology/Energy

The fourth sustainability dimension namely the financial dimension is already represented as one of the 4 main BSC perspectives.

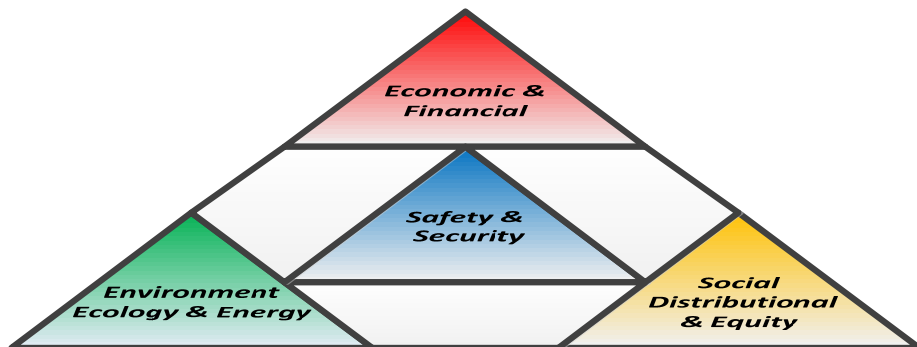


Figure 4. Sustainability Dimensions in Public Transport Organisations (Adapt from [2])

5. INPUTS/OUTPUTS OF A PUBLIC TRANSPORT ORGANISATION

Finally in the selection of KPI an input output analysis exercise has to be conducted, see Figure 5 where there are four types of resources required as inputs by public transport organisations namely financial, human (staff), time, and physical (fleet and assets) resources.

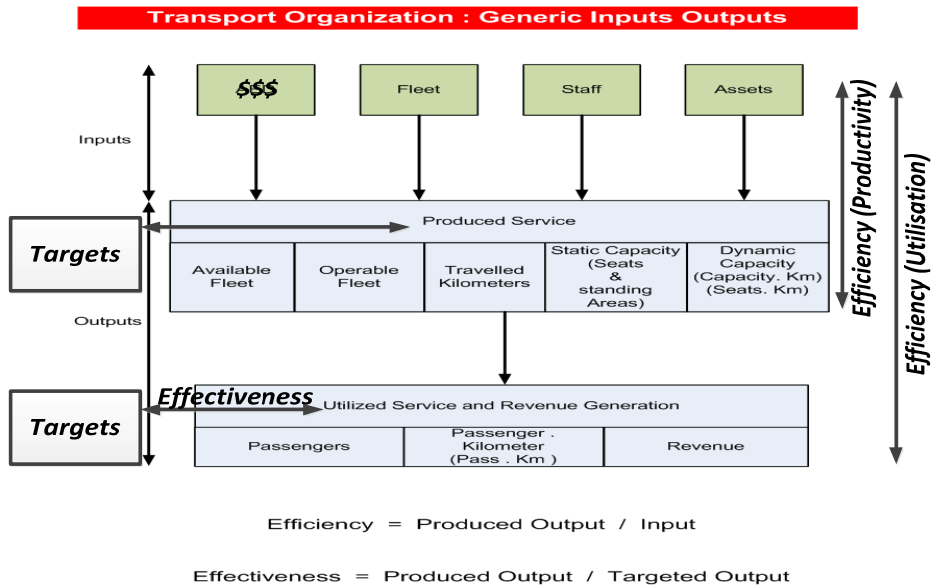


Figure 5. Typical Inputs/Outputs for a Public Transport Organisation

Financial Input: Several sources of funds are available for public transport organisations to finance their activities. These include: retained operational surplus accumulated from previous years; depreciation funds that are kept aside for fleet renewal; bank cash deposits; different forms of loans, grants and/or government subsidies; and any other marketable securities such as share holding in other organisations.

Human (Staff) Input: Public transport organisations employ labour of different levels of skill as drivers, technicians, conductors, inspectors to highly technical staff specialised in planning, evaluation, operation, financing, marketing, engineering, maintenance, & other skills.

Physical Input: Such input could be grouped into fixed assets and material requirements. The fixed assets could be subdivided into revenue earning and non revenue earning. In a typical public transport organisation the revenue earning assets are mainly the rolling stock constituting the fleet. Rolling stock can be categorised by type, mark, capacity, age, and by type of service provided. On the other hand, the non revenue earning fixed assets include land, buildings, depot, workshops, stations and other types of assets. Several material requirements are also needed for operating and maintaining the fleet to an adequate acceptable standard. These include fuel, spare parts, tyres, batteries, oil, lubricants, washing and others.

The management of a public transport organisation is responsible to utilize the above inputs (resources) through the operation of the fleet in order to provide service and financial outputs. The supply of passenger transport services can be expressed in terms of produced service outputs. These include: available/operated vehicles, operated kilometers, operated hours, seats, seat.kilometres. Produced service outputs if not well utilized they become wasted resources but once used they become what are known as consumed service outputs. This is the difference for example between seat.kilometres being a produced output while once these seats are occupied by passengers the seats are consumed and transferred to another indicator known as passenger.kilometres. These include: carried passengers, passenger.kilometres and passenger hours. As a result of utilization of produced service, financial output is also generated in the form of operational revenue obtained through the collection of fares. In the process of providing/obtaining these outputs the company incurs several types of operational expenditure.

These include staff costs (salaries/bonuses/financial incentives), vehicle costs (depreciation, insurance, licensing), fuel costs and maintenance costs (spare parts, oil & lubricants, tires, batteries) and other costs such as taxation, .etc.

6. GENERIC TYPES OF PERFORMANCE INDICATORS FOR PUBLIC TRANSPORT ORGANISATIONS

The outcome performance and achievements of public transport organisations need to be reported and assessed. Eight generic types of performance indicators need to be included to ensure the completeness and wholeness of the assessment, these are as follows:

<i>Key Basic Absolute Indicators</i>	<i>Efficiency Of Productivity (Productivity Indicators)</i>	<i>Efficiency Of Utilisation (Utilisation Indicators)</i>	<i>Other Key Relative Indicators</i>
<i>Effectiveness Of Key Basic Absolute Indicators</i>	<i>Effectiveness Of Productivity Indicators</i>	<i>Effectiveness Of Utilisation Indicators</i>	<i>Effectiveness Of Other Key Relative Indicators</i>

Key Basic Absolute Indicators: These are absolute data indicators that are crucial to compute other relative indicators and that are required to be reported, assessed and monitored. These include fleet size, available fleet, operable fleet, spare fleet, no. of staff, km. travelled, passengers carried, operating cost encountered, operating revenue generated, etc.

Efficiency of Productivity (Productivity Indicators): Productivity can be defined as the amount of output that a unit input produces, see Figure 5. Productivity measures demonstrate how well resources required as input produce outputs that can be utilized. As stated earlier, the supply of passenger transport services can include: available/operated vehicles, operated kilometers, operated hours, seats, seat.kilomtres.

Efficiency Of Utilisation (Utilisation Indicators): Utilisation can be defined as the amount of output utilized as compared to the amount of output produced, see Figure 5. Utilisation measures demonstrate how well produced outputs are consumed/utilized. Produced service outputs once used become consumed service outputs. These include: carried passengers, passenger.kilomtres and passenger hours. As a result of utilization of produced service, financial output is generated in the form of operational revenue obtained via fare collection.

Other Key Relative Indicators: Many other relative indicators exist as related to financial, customer, internal and learn and growth aspects –these are mainly reported in table 2.

Effectiveness Indicators: Effectiveness is concerned with the degree of achievement of targeted (planned) results i.e. an effectiveness measure is the ratio between actual results and targeted ones. Effectiveness can be measured by comparing the actual performance with a pre-selected acceptable performance i.e. cut off values used to distinguish between good and poor performance of each indicator. Assessment of type and magnitude of the discrepancy between the actual and the selected performance is determined. There exist several ways to determine values for the selected acceptable performance (Targets/Cut Off Values). These include:

- Cross-sectional averages, in a single time period, of the performance indicators of public transport organisations operating in the same market.
- Time-series averages, over an extended period of time, of the performance indicators of public transport organisation under assessment.
- Cross-sectional averages of time-series averages of performance indicators of bus companies operating in same market including/excluding the company under evaluation.
- Internationally published values for performance indicators can be used as benchmarking

7. DASHBOARDS/REPORTING STRUCTURE OF KPI

This research has shown the way forward for attaining an optimum KPI system for public transport organisation. The paper demonstrated the framework within which KPI should be identified, selected, categorized and assessed. Such framework takes into account all inputs and outputs in which the non homogenous nature of the inputs and outputs can be correctly accommodated. The following integrated framework is developed as being appropriate for higher management dashboards, see Figure 6. The figure shows that the framework is composed of seven main performance categories to be measured via 8 generic types of measurements and as previously explained.

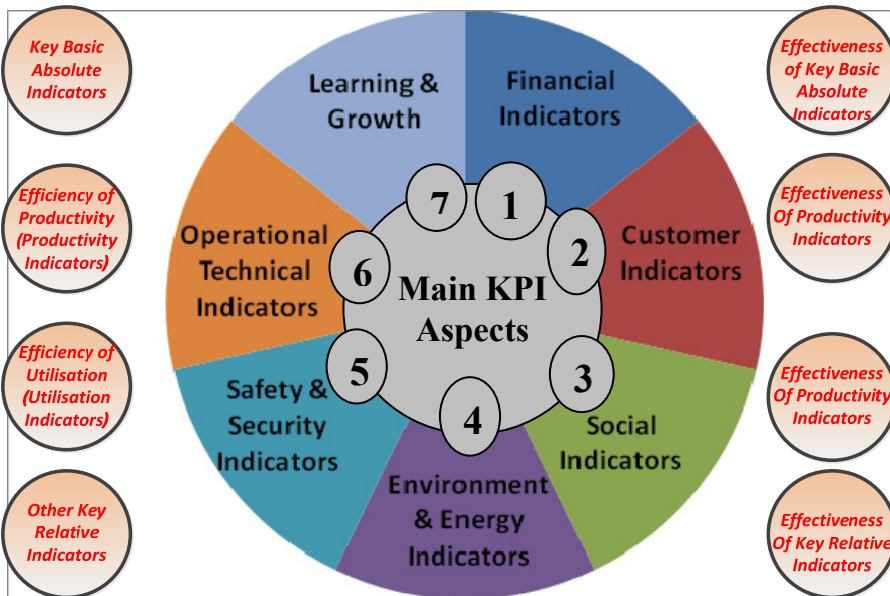


Figure 6. Integrated KPI Framework for Typical Public Transport Organisation

Furthermore, table 2 shows a number of carefully identified & selected indicators in accordance with BSC 4 perspectives/16 Sub-Perspectives to better represent public transport organisations.

Table 2. Identified/Selected KPIs to Better Represent Public Transport Organisations

Investment Capital Investment / bus Capital Investment / 100000 km Capital Investment / 10000 passenger Capital Investment / 100000 pass.km Rate of Return		Cost Cost / bus Cost / 100000 km Cost / 10000 seat Cost / 100000 seat.km Cost / 10000 passenger Cost / 100000 pass.km Fines Value / Bus Fines Value / 100000 Km		Complaints/Claims Complaints / 100 Driver Complaints / 100 Bus Complaints / 10000 km Complaints / 10000 passenger Complaints / 100000 pass.km		Satisfaction/Happiness Recognition & Thank you / 100 Driver Recognition & Thank you / 100 Bus Recognition & Thank you / 10000 km Recognition & Thank you / 10000 passenger Recognition & Thank you / 100000 pass.km	
Profit/Subsidy Profit/Subsidy Cost Recovery Ratio Profit/Subsidy per bus Profit/Subsidy per 100000 km Profit/Subsidy per seat Profit/Subsidy per 10000 seat.km Profit/Subsidy per 10000 passenger Profit/Subsidy per 100000 pass.km		FINANCIAL		Revenue Revenue / bus Revenue / 100000 km Revenue / 10000seat Revenue / 100000 seat.km Revenue / 10000 passenger Revenue / 100000 pass.km Fare/Pass.km		CUSTOMER	
Education/Training/ Knowledge Transfer No of PhD/Total Technical Staff No of Masters/Total Technical Staff No of Bachelors/Total Technical Staff No. of Tech.Trained Staff/Total Tech.Staff No. of Manag.Trained Staff/Total Manag. Staff No. of Vocationally Trained Staff/Total Vocational Staff No. of Training Courses-workshops/Staff No of Train the Trainers Courses-workshops/Staff No. of Training hours/Staff No of Train the Trainers hours/Staff		Research/Innovation/ Initiatives Number of Research Proposals/Technical Staff Number of Research Projects/Technical Staff Number of Research meetings/Technical Staff No of Innovations/Technical Staff No of Initiatives/Technical Staff		Technical Average bus age - Load Factor Fleet Availability Ratio - Fleet Spare Ratio - Fleet Operability Ratio-Fleet Utilisation Ratio Travelled kilometers/total fleet Travelled Kilometers/ available fleet Travelled kilometers/Operable fleet Travelled kilometers/Utilised fleet Breakdowns/Bus- Breakdowns/kms Operable Buses/Available Buses Pass.km/Veh.km - Passengers/bus Passengers/staff - Pass. On Time Performance/Total Pass. - Road Failures/km. Travelled Standing Passengers/Seated Passengers - Average Passenger Waiting Time - Average Operational Hours with no AC/Total Operational Hours Staff/ Bus - Staff/Available fleet - Staff/Operable fleet - Staff/Utilised fleet - Dead Km/TotalKm -Rev Km/TotalKm Dead Km/Revenue Km - Spare Drivers/Total Drivers - Average Transfer Times - Covered Population/Total Population Meantime between Failures		Social/Distributional/Equity Availability (%age of Hours Service is Available) Accessibility (% of areas having public transport accessible within 500 m.) Accessibility (% of Population having public transport accessible within 500 m.) Equity (% of mobility handicapped passengers) Equity (% of Elderly Passengers) Equity (% of Women Passengers) Affordability (Fare to Income)	
Rewards/Recognitions No of Rewards/Technical Staff No of Recognitions/Technical Staff No of Prizes/Technical Staff No of International Certifications/Technical Staff No of Attended Conferences/Technical Staff		LEARN & GROWTH		Environment/ Ecology/Energy Emissions / kilometer Fuel consumption / kilometer % of environmentally clean fleet		INTERNAL	
Empowerment No of Staff Seconded to Senior positions/Management Staff No of Staff Leading Committees or teams/Total Staff No of deputy directors/No of directors No of deputy managers/no of managers		Safety/Security Accidents/100000 km - Fatalities/100000 km Slightly Inj./100000 km Accidents/100000 pass - Fatalities/100000 pass Slightly Inj./100000 pass Slightly Inj./100000 pass Accidents/M. pass.km- Fatalities/M. pass.km Slightly Inj./ M. pass.km- Slightly Inj./M. pass. Km					

8. CONCLUSION

Management of public transport organisations is becoming an increasingly complex and sophisticated task. Managers have to manage their fleet, providing high quality services, attaining profitability and customer happiness. The various elements involved in management of public transport organisations call for coordinated approaches for assessing performance, identifying, examining and solving problems. KPIs are a well known management technique that can assist in achieving the above. This paper stressed the importance of KPIs to be used by all levels of management of public transport organisations as well as by different audit and governance bodies concerned with the evaluation of the achievements of bus companies. Many public transport organisations are facing a number of issues and limitations in the utilization of performance indicators including that selected KPIs do not separate key activities of the organisation nor do they cover all functions, as well as that the number of KPIs may be too much causing confusion or too little to assist planners, decision makers, auditors and governance agencies in their roles.

KPIs may not be timely reported and in many organisations reliance is on absolute KPIs rather than relative ones.

Hence this research was concerned with developing a generic methodology that can assist in the optimum selection of the 3 Rs i.e. right mix of KPI, right type of KPI as well as right reporting times. Towards this end the paper identified 3 main frameworks that were employed to categorise and select the required set of key performance indicators. The management framework known as balanced scorecard, the sustainability framework, and the input output framework were utilized in a hybrid fashion to ensure an optimum categorization and selection of KPI system for a public transport organisation. This research first employs the 4 perspectives of the balanced scorecard, namely financial, customer, internal business process and learning & growth. The research further categorises each one of these four perspectives into another 4 Balanced Score sub-perspectives (i.e. $4 \times 4 = 16$). These are meant to better represent many organisations but more specifically public transport organisation. These took into account the 4 sustainability dimensions namely financial, social, environment and energy, safety & security.

Finally in the selection of KPI an input output analysis exercise was conducted, where 8 generic types of performance indicators for public transport organisation were included to ensure the completeness and wholeness of the KPI assessment. These include: key basic absolute indicators: efficiency of productivity (productivity indicators), efficiency of utilisation (utilisation indicators), other key relative indicators and finally effectiveness indicators for all KPIs. The suggested KPIs are available in many public transport organisations but at the end of the day it should be left for each transport organisation to select the final set of KPIs taking into consideration the coverage of the particular categories/aspects that are suggested as key to ensuring optimum KPI package selection. This research has shown the way forward for attaining such an optimum KPI system. The paper was not meant to provide a particular case study but rather to demonstrate the generic framework within which KPIs should be identified, selected, categorized and assessed in a hybrid fashion. Towards this end an integrated framework was developed as being appropriate for higher management dashboards. The framework is composed of seven main performance categories to be measured via 8 generic types of measurements. Furthermore, a number of carefully selected indicators in accordance with BSC 4 perspectives and 16 Sub-Perspectives were identified to better represent public transport organisations and a dashboard reporting structure was suggested. The process described in this paper has the advantage of enhancing management ability, improving mental concepts that people possess about public transport organisations, as well as providing a rich medium for gaining intuition and acquiring knowledge by experience and learning.

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