Chapter IV

DECISION SUPPORT SYSTEM AND OPERATIONAL EFFICIENCY
It is certain that no organisation, even in the next few years of 21st century, can ensure efficiency and productivity without massive commitment to computer revolution. The existing system of trade and commerce have undoubtedly become faster, cheaper and easier than before. Both merchants and customers are looking forward to a better, smarter and happier life ahead. In this electronic age, every thing is getting designed for people without causing any inconvenience and constraints. The organisations are faced to introduce and manage technologies for their survival and development. The role of computers become very necessary in order to speed up procedures and routine tasks and to relieve managers from the tedium. It has become almost imperative for the present day managers to depend on computer not only for processing large volume of data, but also for communicating data and information from one place to another. The micro revolution has virtually made the business and industrial organisation to depend on computers for getting right information at the right time to aid decision-making process.

In India, the State Road Transport Undertakings constitute the single largest network providing transport to about 10 million passengers per day. Over Rs.4000 crores are committed in them by States and Central Governments since 1951. They have a fleet-strength of about 1.2 lakhs which account for about 60 per cent of the total investment. It is an open secret that majority of the STUs in India are operating in losses today. Ultimately the question arises whether the STUs are not able to maintain their economics of transport operation or whether the external circumstances are pushing these undertakings into losses. The question is minor or of less importance, in the present monopoly situation, whether the STUs are responsible
or whether the free market condition is responsible, the major question is about the "service" which is being provided to the honorable passengers in terms of quality and quantity of operation. It is a fact that the demand for transport has abnormally increased due to the social, economical cultural and educational developments in the country. Due to rapid industrialization and agricultural development, the Gross Domestic Product (GDP) gas increased and simultaneously the per capita income has also increased with the result people are demand more and more transportation service in terms of quantity and quality of the services. It is a very basic principle that to increase the output in terms of quantity and quality, finance is required. But due to financial crunch, at present, STUs are unable to expand their operations or to improve their service quality up to the required standard. Even, it can be seen that these STUs are losing their confidence due to instability in their operation. The very basic question of "survival" is before them. In addition to these, budgetary support for these STUs was curtailed forcing STUs to become financially viable. Even in this hostile environment, some STUs managed to earn profits. This demonstrates that even within the existing framework, there exists a considerable scope for improvement. APSRTC is no exception to these conditions prevailed in the passenger transport industry. The STUs should think, not only from the cost and revenue aspects only, but also from different angels. They have to focus their attention on resource utilisation, constant performance monitoring, efficient vehicle scheduling, economy in personnel cost, improving staff productivity and increasing quantity and quality of service. The STUs have to search for various available alternatives to improve their performance in these aspects. The best option for STUs is to undertake a massive deployment of
Information Technology and designing and establishment of “Information Systems” in the potentials areas. This imposes a need for a tool / system to gather, store, process, update and retrieve passenger information. Hence, a growing need and opportunity exist in the STUs to establish “Decision Support System”, a useful information system, for both improving their operational performance and for providing indigenous end user solutions.

DECISION SUPPORT SYSTEM

The organisations design and establish the different information systems to meet their informational needs. Today, a large portion of the world population has its stake in information systems and invariably such systems are computer based. Ever since the use of computers for the American Census in 1954, the commercial applications of computers have far exceeded the scientific applications. The predominant commercial applications in the 1950’s were payroll processing, billing and other routine clerical and accounting operations. The business data processing of the 1950’s in termed as Electronic Data Processing (EDP) and later the word electronic was dropped from it with computer becoming a commonplace thing. During 1960’s great advances took place in hardware and software such as development of various high level languages and huge and fast access secondary storage devices. These advances led to the development of Management Information System (M.I.S.) and it become wide spread during the late 1960’s. When the early computerization efforts in organizations moved form EDP to MIS framework and large systems were built, the experts perceived that the bulk of the information generated was routine and only a small amount of vital information will directly
useful for decision making. Such vital information could not be generated without the organised efforts of EDP and MIS staff. However, the decision support information needed for more analysis capabilities, and not more information storage and processing. During the 1970's further advances in hardware and software such as micro computers, interactive display devices, user-friendly software and improvements in database technology paved the way for Decision Support System (DSS). A DSS is an interactive, flexible and adaptable computer based information system that utilizes decision rules, models and a model base coupled with a comprehensive database and the decision-maker's own insights. Using the DSS leads to specific, implementable decisions in solving problems that would not be amenable to management since optimisation models per se. Decision Support System assist managers/decision makers in making unstructured decisions. The system enables them to interact with the database, model base and other software and generate the information they need rather depend on some reports produced according to some planned information needs. A DSS aids the solution of complex problems and enables a thorough, quantitative analysis in a very short time. In the words of Sadagopan, Decision support systems are systems that support decision making using flexible access to data and models for use by end users; the systems should provide flexible interfaces to support non-routine, unstructured decisions often involving uncertain decision situations and multiple objectives with provision for incorporating the decision maker's individual style of decision making.
DSS FOR STATE TRANSPORT UNDERTAKINGS

State Transport Undertakings need to think differently about information and technology. Historically these STUs have been using the technology mainly for making administrative functions more efficient. They had a network for gathering large quantities of data, but very little useful information. Their earlier databases were designed and built based on services and not on customer needs or the traffic demands. Now STUs are thinking of potential for computerisation and Information Technology deployment in strategic areas. They are not just referring to computerisation, but also automation of certain tasks. New opportunities are emerging in the field of passenger transport due to technological advancements which made the transport organisations to gather, store, access and management of information easier. Simultaneously the general ability to use information is becoming a competitive weapon in delivering high quality and efficient service to the customers.

Transport undertakings need to utilise decision support systems by implementing data warehouses that pull information from existing legacy systems into a customer information database. Such decision support systems will equip the STU managers with ability to allow for customised services as per the passenger expectations and needs. Any need to analyse the STUs physical, operational financial and passenger data quickly and easily to improve their performance and business profits warrants the need for a decision support system.
DECISION MAKING ENVIRONMENT IN APSRTC

As an STU, the Andhra Pradesh State Road Transport Corporation should formulate various policies and strategies for improving its physical and financial performances to achieve the objectives laid down in the R.T.C Act and also the targets and targets will be fixed for both revenue and costs. The corporation should make efforts to achieve these objectives thorough the depots, spread all over the State as the depots are the first and the fundamental functional unit, on which the entire structure of the corporation is based. The ultimate responsibility of executing the policy decisions taken and achieving the targets and standards fixed by the corporation, rests on the shoulders of the Depot Manager as the functional head of the Depot.

The organisation structure of APSRTC reveals that various executives are involved in strategic planning, tactical planning and operational control activities done at top level middle level and depot level. As they have to perform different functions, the informational needs of each manager is different form the others. Whatever the level of commitment and involvement in performing the major functions like planning, decision making and controlling, they need 'information' to plan and perform their functions effectively. Serious efforts are to be made by the corporation to design and establish an information system which provides useful information to all managers or decision makers at all levels. The corporation need to sense and respond productively in collecting, storing and using the information which will be more helpful in identifying customer needs and desires, monitoring the services, co-ordinating the activities and evaluating the performances for increasing
overall efficiency and financial status of the organisation. Hence, the determination of activities to be performed at different levels helps in knowing the decision making environment in APSRTC.

The top level management of APSRTC deals with strategic planning (determination of organisation objectives and formulation of long-term policies) and decision making activities which relate to:

- formulating the plans and policies for improving bus productivity and manpower productivity;
- forecasting the fleet and manpower requirements to meet the traffic demands of the future;
- analysis of the factors that affect the financial position of the organisation;
- forecasting of future financial commitments and evaluating the alternatives to meet them;
- fixation of fare structure per passenger km. For different services (ordinary, express, semi luxury, etc.);
- decision making on location of facilities depots, plants, and terminals;
- analysing impact of wages and incentives on the overall cost and productivity;
- decision making on incentives to the employees and extending concessions to some section of the travelling public;
- formulation of strategies to meet cut throat competition arises from different operators;
formulation of policies and adoption of strategies to improve the financial viability of the organisation; and

- analysis of overall physical and operational performances and the appropriate measures to increase the quality of service.

For performing the above functions effectively, the top level managers require information to be collected both from internal and external sources. They largely depends on the information of entire organisation and external information. They have to take more unstructured decisions and generate the information they need rather than depend on some reports produced according to some planned information needs.

The middle level managers at the depot level in APSRTC deals with tactical planning (allocating resources, decision making on short-term objectives, strategy implementation, information dissemination, development of operational decisions, communication, etc.,) and decision –making activities relate to:

- determination of fleet size and staff requirements;
- decision-making on route scheduling and deployment of buses;
- analysis of crew and vehicle schedules;
- analysis of performance and profitability at route levels using standard indicators of productivity and profitability;
- decision making on policies related to service mixes (combination of different services) to be adopted;
- analysis of fuel efficiency, material tyre and spare parts consumption;
- assist the top level management in giving detailed information relating to the current and possible availability of resource to formulate strategies;
- generation of financial and operational reports with past, present data at depot, and route levels;
- analysis of crew performances based on the parameters of staff productivity, absenteeism, punctuality, etc.;
- fixation of standards or targets and work loads to the operatives (crew) in a systematic fashion; and
- assessing the impact of illegal operations and their on revenue.

To perform the above functions effectively, the middle level managers require a useful information mostly from the internal sources. As they have to take semi-structured decisions, they require to follow time series analysis methods and graphical summaries to observe the trends and patterns in the data gathering information for the preparation of various statements and reports and project the information about the environment, they need information with more decision support capabilities which will be helpful for tactical planning.

The lower level managers (supervisory levels) in APSRTC deals with operational control performance evaluation, identifying the deviations, monitoring of day-to-day operational activities of their section, co-ordinating, giving feedback, organising, etc.) and decision making activities relate to:
- allocation of duties, targets and workloads in a systematic fashion;
- supplying feedback information to the higher levels;
- provide effective direction and to motivate staff members to give their best performances;
- implementing the tactical plans and decisions taken by the middle level managers;
- performance measurement and presenting the details to the immediate higher levels; and
- preparation of regular reports and statements (about operation of schedules, cancellations, rout-wise earnings daily vehicle position, fuel consumption, punctuality of services, inventory position, etc.) and presenting them to the higher levels.

To perform the above functions, the lower level managers require information/data gathered from planned and established arrangements. They are more involved in tackling programmed decisions on the basis of information generated through the operations and performance of activities.

**BASIC DATA REQUIRED FOR THE DSS:**

APSRTC requires a large data for developing Decision Support System to increase its operational efficiency and effectiveness in functioning. Information obtained from the records/documents maintained at the depot level is to be considered as a vital information for decision making. As such enormous responsibility has been assigned to a Depot Manager to maintain the up to date records and keep vulnerable and vital information on his finger trips to monitor the
day-to-day performance fleet and crew at the depot level and submit various reports to the Divisional, Regional and Head office levels. There are various basic documents in a depot. Though these documents look very simple and familiar, their usage is manifold and unlimited. The following documents and statements (maintained at Depot level) provide the basic data required for the DSS in APSRTC:

WAY BILLS

Every conductor while going on duty will be supplied with a way bill which will carry the information about the various denominations of tickets sold and the amount realised. The conductor after completion of the duty fill in all the information and submit the same to the Ass. Depot Clerk. Total earnings realised and kilometres operated by the depot will be worked out after scrutiny of way bills.

LOG SHEETS

Every day, each bus leaving the depot will be supplied with a log sheet, which holds the information about the trips and the kilometres operated, oil top up, vehicle number and the driver’s name. The driver who operate the bus has to fill up the required information and after completion of the day it will be submitted to the mechanical supervisor.

STATISTICAL RETURN

The first and the foremost document is the Statistical Return popularly known as SR. A close and careful scrutiny of this primary document reveals several factors. It may be possible to use census method and ensure 100% scrutiny but it is essential to carry out random checking regularly to know about the punctuality of the
operations, number of passengers boarding and alighting at each point, whether any alternations are made by the conductors/booking clerks with a fraudulent motive to reissue the tickets and accountal thereof etc. Similarly waybill records the financial profile of a conductor while on duty. There are several instances where conductors and Asst. Depot Clerks, who indulge in fraudulent activities, were caught by audit of way bill and scrutiny of S.R.

OIL ISSUE Registers

This register will be maintained by the Depot Clerk (oil), in which oil issued to various buses and kilometres operated by them are given.

TYRE CARD

Every new tyre received from the manufacturer will be given a serial number by the stores wing and the tyre will be supplied to the depots along with a tyre card. This card will carry the entire information about the particular tyre viz. kilometres operated, first retread, second retread etc.

TASK REGISTER

This register is very useful to a depot Manager. It holds the daily information about the various key indicator of the depot. The information shown in the register consists of:

- **Earnings**: Daily, cumulative and average
- **Kilometres Operated**: Daily, cumulative and average
- **Rate of Earnings**: Daily and average
Vehicle Utilisation : Daily and average
Earnings Per Bus : Daily and average
Fleet Off Road : Daily, cumulative and percentage
Fuel : Daily, cumulative and revenue KMPL
New Tyres : Daily, cumulative and Average consumption
Non - Revenue kilometres : Daily, cumulative and percentage.

VEHICLE LOG BOOK

Every new vehicle on commissioning will be provided with a vehicle log book, in which the entire life history of the vehicle is shown viz. kilometres operated, number of overhauls, replacement of major spare parts etc.

DRIVER-WISE KMPL AND VEHICLE-WISE KMPL

Based on the information derived from log sheet and the oil issue register two registers are prepared to find out the driver-wise and vehicle-wise KMPL which forms the important cost control items. By going through these registers a Depot Manager can pin point the low KMPL drivers and vehicles and can take corrective action to improve the KMPL.

In addition to the above registers the following statements are also prepared at the depot to submit the same to the higher, authorities at the Divisional and Regional level.
BASIC DOCUMENTS AT DEPOTS IN DETAIL

DAILY EARNINGS STATEMENT

This statement is prepared daily, in which the details such as the earnings, operated kilometres, earnings per kilometre and the vehicles operated are given. The above information's are shown according to the type of the vehicle viz. Deluxe, Semi Luxury, Super-Express and Ordinary services.

DELAYS AND CANCELLATIONS STATEMENT

This statement shows daily scheduled, operated and cancelled kilometres. The cancelled kilometres are shown with reason for cancellations viz. want of bus, late supply, tyres, mechanical, want of crew, agitation, accidents etc.

ROUTE-WISE EARNINGS AND KILOMETRES

This statement is prepared for every ten days. In this statement the route-wise earnings, operated kilometres, earnings per kilometre, occupancy ratio and tyre type of the vehicles operated are shown. The occupancy ratio shown in this statement is an indicator for augmentation or withdrawal of vehicles on any particular route.

DAILY VEHICLE POSITION

Daily vehicle position statements are prepared every day at the depot.

This statement gives the following particulars:

- Number of buses on the rolls of the depot
- Departmental vehicles (total)
- Buses required

- Operated vehicles

- Particulars of the workshop vehicles (vehicle No., dispatch date, number of days remained at the workshop and remarks it any)

- Particulars of the scrap vehicles at depot (No. of days stabled, reasons for keeping the vehicle at depot)

- Particulars of the buses not operated (reasons for detention, date form which detained, No. of days detained etc.)

FLEET STRENGTH REPORT

The Fleet Strength report is prepared in APSRTC fortnightly. It gives the following particulars:

- Name of the depot

- Bus number, type and make

- Vehicles transferred and received during the fortnight and

- Total number of buses in the depot as on the last day.

VEHICLE INVENTORY

This is the monthly report on advice of progressive kilometres prepared by the depots in the serial order of vehicles. The particulars of this reported are vehicle No., type of the vehicle, make of the vehicle, data of commission, kilometres traveled since last complete overhauling, date of expiry of fitness certificate of the vehicle, condition of the vehicle units and the remarks if found any.
FUEL STATEMENT

These documents are prepared fortnightly at depots. The particulars of MTD 29 are:

- Opening balances of fuel
- Quantity of fuel received from IOC
- Noting the voucher number
- Out depots fuel quantity received
- Oil issued to depot vehicles
- Oil transfers to out depots and
- Closing balance.

All these particulars should tally with every log sheet and the KMPL register.

DSS ENVIRONMENT FOR INCREASING OPERATIONAL EFFICIENCY AND FINANCIAL VIABILITY OF APSRTC:

DSS will become inevitable in coming days for public sector passenger transport undertakings as it plays a major role in increasing their operational efficiency and financial viability. The DSS serves as an efficient tool for conducting performance analyses on passenger transport operation systems for effective planning, and monitoring focusing more on crucial operational aspects. It provides a common platform for comparison of performances even among various depots of APSRTC by using suitable performance indicators. DSS provides enormous scope of monitoring the important systems on a day-to-day basis. The information with DSS capabilities
will be useful at the depot and divisional level of APSRTC to help manager to perform various activities to improve operational efficiency and thereby financial viability of the corporation. DSS helps in performing functions like scientific scheduling of vehicles, review of operational performance (route wise, bus-wise), monitoring the punctuality, resource planning, inter-STU comparison, periodic review of occupancy ratio, determining the trends in fuel cost, cost on spare parts and tyre cost, analysis of various cost elements, periodic checking of fuel and oil performances, identification of peak and off peak hours, period review of revenue aspects, analysis of accidents, review of low earning routes, analysis of excess or savings, periodic review of cancelled kilometres and trips, etc. DSS helps in analysing physical, operational and financial data of past and present periods very quickly and easily. It also helps in analysing the functional aspects of components of 'quality of service' like punctuality, regularity, reliability and frequency. DSS plays a key role in formulating strategies and policies for improving the overall productivity.

Annexure – I presents information on DSS environment for improving both operational efficiency and financial viability of A.P.S.R.T.C. It presents the details on some important strategies to be adapted, the basic data required for formulating the strategy (or to develop a decision) and the activities to be performed in information and execution of concerned strategy. To improve the operational efficiency and financial viability, the corporation need to (i) improve the bus productivity, (ii) design the routes and schedules accurately, (iii) plan the manpower requirements, (iv) improve fuel performance for conserving oil substantially, (v) ensure high regularity and punctuality, (vi) reduce accidents rate and breakdowns rate.
### ANNEXURE - I

**DSS ENVIRONMENT FOR INCREASING OPERATIONAL EFFICIENCY AND FINANCIAL VIABILITY OF APSRTC**

<table>
<thead>
<tr>
<th>Strategy/decision to be adopted</th>
<th>basic data required on</th>
<th>activities to be performed</th>
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<tbody>
<tr>
<td>1. Improve bus productivity</td>
<td>- Fleet strength</td>
<td>- Route Rationale</td>
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<tr>
<td></td>
<td>- Vehicle utilisation</td>
<td>- Scientific scheduling</td>
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<tr>
<td></td>
<td>- Volume of operation</td>
<td>- Assessment of road condition</td>
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<td></td>
<td>- % Effective kms.</td>
<td>- Estimation of traffic demand</td>
</tr>
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<td></td>
<td>- Route scheduling</td>
<td>- Maintenance of vehicles in good condition</td>
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<td></td>
<td>- Travel time</td>
<td>- Less number of spare vehicles at the depot</td>
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<td></td>
<td>- Traffic demand</td>
<td>- Periodic review of cancelled kilometres and trips</td>
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<tr>
<td></td>
<td>- Accidents rate</td>
<td>- Adherence to planned schedule</td>
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<tr>
<td></td>
<td>- Breakdown rate</td>
<td>- Periodic review of kilometres performed by each vehicle</td>
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| 2. Designing of the routes & schedules | - Stages and stops  
- Service timings  
- Frequency  
- Density of travel  
- No. of vehicles  
- Trips operated Average route length in kms  
- Average speed of services  
- Earnings per bus  
- Basic fares | - Planning the connectivity  
- Monitor the punctuality  
- Collect customers’ views  
- Resource planning  
- Assessment of revenue performance financial analysis)  
- Inter-STU comparison of basic fares |
| 3. Man power planning        | - Growth in vehicle fleet  
- Bus-staff ratio  
- Category-wise staff requirement  
- Retirement of staff  
- Staff to be recruited  
- Salary level | - Estimation of fleet held and buses on road  
- Determination of existing staff ratio  
- Estimation of “Personnel Cost”  
- Estimation of profit/loss |
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| 4. To improve fuel | - Fuel consumption  
- Bus-wise fuel consumption  
- Driver-wise kmpl  
- Road condition  
- Average speed  
- Quality of overhaul  
- Inter-STU data on kmpl  
- Load factor | - Training for mechanical staff  
- Training of supervisors, Engineers and managers.  
- Administering “incentive scheme” to motivate staff  
- Taking technical measures |   |
| 5. To Ensure high regularity and | - Time Table  
- Average Running Time  
- Condition of the Bus  
- No. of stoppings | - Design and implement motivating incentive scheme  
- Scientific route study  
- Determination of frequency to be maintained  
- Accurate recording of departure, arrival timings  
- Collect customers’ views Identification of unavoidable barriers |   |
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<tr>
<td>6. Reduce accidents rate and breakdowns rate</td>
<td>- condition of vehicle</td>
<td>- Maintenance of vehicles in good condition</td>
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<td></td>
<td>- Road condition</td>
<td>- Training of staff (driver)</td>
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<td>- Driver habits/attitude</td>
<td>- Proper investigation and analysis of</td>
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<td></td>
<td>- Load factor details</td>
<td>accidents</td>
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<td></td>
<td>- Bus accident statistics</td>
<td>- Fatigue studies</td>
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<td></td>
<td>- Make of tyre</td>
<td>- Road category-wise analysis of</td>
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<td>- Causes of accident</td>
<td>accidents</td>
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<td></td>
<td>- No. of Fatal accidents</td>
<td>- Physical survey of roads</td>
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<td></td>
<td>- Total major and minor accidents</td>
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<td>- No. of personnel died/injured</td>
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<td>- Compensation paid to the parties</td>
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<td>- Driver’s age</td>
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<td>- Weather conditions</td>
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<td>- Speed of travel</td>
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<td>- Past record of driver</td>
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<td>- Age of victims</td>
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<td>- Direct costs of damage</td>
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| 7. Fixing Fare structures | - Operating cost  
- Total cost  
- Expected surplus  
- Load factor/occupancy ratio  
- Existing fare structure  
- Seasonality of travel demand  
- Competition  
- Operating conditions  
- Cost trends of diesel, staff, tyres, etc.  
- Consumer price Index  
- Last fare revision  
- Concession | - Analysis of various cost components  
- Forecasting trends in fuel cost and tyres cost  
- Ascertainment of cost  
- Determination of economic fare  
- Forecasting traffic demand  
- Determining the level of Competition | |
| 8. Cost control and revenue maximisation | - Total cost  
- Operating cost  
- Fixed and variable cost  
- Cost per effective km.  
- Revenue per eff. Km.  
- Taxes paid per bus  
- Route wise revenue  
- Service wise revenue  
- Total traffic revenue | - Analysis of trend of each cost element  
- Analysis of excess or savings  
- Period checking of fuel and oil performance  
- Period review of tyre management practices  
- Period review of spare parts consumption  
- Identification of new routes  
- Review of low earning routes  
- Taking measures to enhance traffic revenue  
- Periodic review of occupancy ratio | |
considerably, (vii) fix the fare levels economically, and (viii) concentrate on cost control and revenue manimisation.

Decision support systems are expected to play a key role in strategic planning, management control, appraisal of performance, tactical decision-making and operational control. As an adaptable computer based information system, a DSS will play a significant role in the management of APSRTC and its operations. The DSS modules will provide the necessary guidance to all levels of managers of APSRTC in effective decision making solutions to various problems affecting the performance of APSRTC mainly lie in providing necessary computerised tools that deal with the analysis of various cost components, staff and vehicle productivity, cost-revenue analysis, capacity utilisation, etc,. The APSRTC has to design and establish efficient information systems with DSS capabilities to take decisions and give pertinent solutions to various problems of thrust areas relate to: computer aided analysis of services and operations, route scheduling, route profitability, staff productivity, cost control, quality of service, fixation of fares; and formation of future growth policies including undertaking of new routes, location of new bus terminals, fleet expansion, staff recruitment, etc. Information generated from the operation of buses and its effective utilisation will lead to improvement in operational efficiency and better financial position of APSRTC.
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1 Mohan, P., “Management Information systems”, Himalaya Publishing House, New Delhi, p.4
