Annex 3

Service Costing and Profit Measurement Systems

1 Use of Service Costing and Profit Measurement Systems

Service Costing and Profit Measurement Systems (SCPM) provide detailed cost and profitability information for railways service provision. Typically, railways fixed costs are substantial and shared broadly by all traffic groups. So most SCPMs calculate variable costs, and measure service profitability by how much the service contributes to the railway's fixed costs (e.g., contribution = revenue - variable costs).

Railways use SCPMs to provide information for the following activities:

- Commercial pricing
- Prioritizing use of scarce resources
- Identifying opportunities for cost reduction
- Investment analysis

The primary purpose of any SCPM system is to *support commercial pricing decisions*. The general principle of commercial pricing is to maximize profit (the services' contribution to the railway's fixed costs), knowing both the costs and the market. This principle is sometimes expressed as "price to the market, not to costs....but price above costs."

Box 1 You Cannot Make It Up On Volume

In 1980, during an economic recession, railway pricing in the US was deregulated. Railways were eager to use their new pricing freedom to attract as much traffic as possible to their lines. One railway management decided that their marketing department should *not* know the service provision costs because, "We want them to price to the market. Even if we lose money on individual movements, we can make it up on volume." Development of a SCPM model for this railway disproved this approach and provided the marketing staff with tools they needed for market-based pricing decisions to improve the railway's finances.

To make the best pricing decisions, railway marketing staff must know both their customers and their competition—whether, for example, a small price reduction is

likely to cement existing client loyalty and perhaps lure clients from competitors. The SCPM role is to ensure that marketing staff know the price level that is viable in the face of the railway's variable costs of providing the service. At prices below variable costs, the railway would lose money.

SCPM system information is used prospectively for pricing and retrospectively for evaluating marketing department staff performance. The system's costing methodology must be applied consistently for both purposes.

Commercial railways use SCPM systems to *allocate scarce resources*. For example, during a period of locomotive shortage, a U.S. freight railway used its SCPM system to determine the profitability of each traffic type and prioritized locomotive allocation to trains hauling the most profitable traffic. Similarly, commercial railways use SCPM's profitability measurement to allocate capacity on crowded railway lines. When capacity is oversubscribed, the railway may increase the contributions required from all traffic. This prices the least profitable traffic off the railway, freeing up capacity for the more profitable traffic.

The SCPM system also provides *information for cost reduction* by relating railway activities to costs. The system provides a structured view of costs, allowing the railway to benchmark service cost components and identify those that are too high. The SCPM also specifies cost variability, thus identifying costs that are too inflexible, leading to efforts to rectify this. For example, during the 1990s, the U.S. railways transformed most labor costs from fixed to variable, a major effort that required renegotiating crew contracts, modifying train planning, and altering management practices.

Finally, the SCPM provides information for *investment analysis* by providing baseline ("before investment") costs to compare with the after-investment scenario. When railways management is considering line upgrades, sales, or closure, they can use data from the SCPM to analyze revenues and costs for all traffic handled on the line segment. If management is considering a new service, they can use SCPM information for projecting costs, based on data from similar services.

To satisfy all these uses, the SCPM system must have the following characteristics:

- *Timely:* Data must be available immediately when needed.
- *Accurate:* Results depend on accurate underlying data, without which cost calculations will seem unreasonable to users, who will then ignore system results.
- *Specific:* The value of the system is providing costs specific to services provided.
- *Unbiased:* Users must view the system as impartial since it may be used to evaluate staff performance, allocate resources, and make investment decisions.
- *Multi-dimensional:* The system must provide short-, medium-, and long-term costing for decisions with multiple time horizons.
- *Easy and flexible:* Being user-friendly will facilitate broad use.

2 Costing Concept

The SCPM system costing component relates railway costs to services by applying variability and causality.

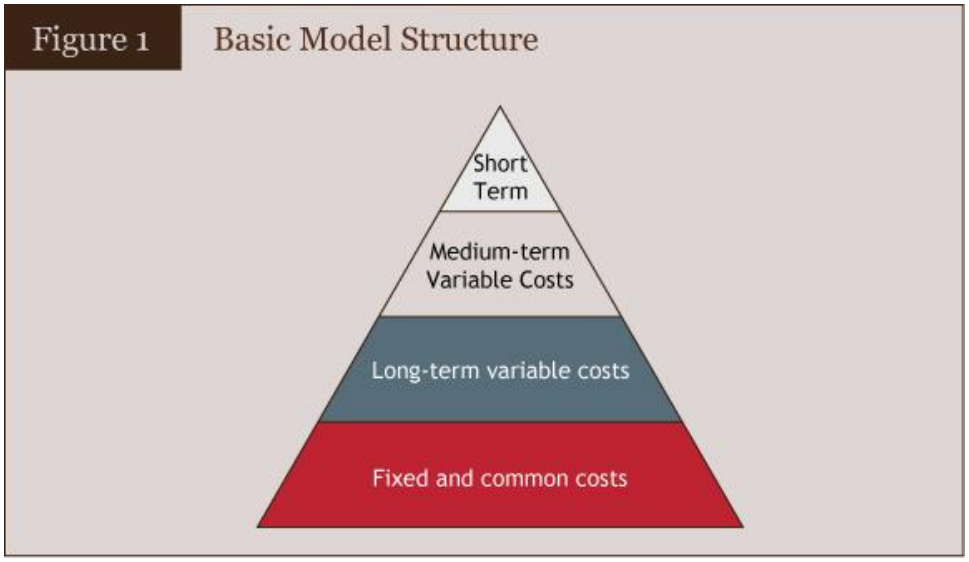
2.1 Variability

Railway costs vary with traffic volume—it costs more to carry 100 million tons than 1.0 million tons of freight. Figure 1 below shows that, some costs vary with traffic volume right away, while others take a longer time to vary with traffic volume. For example, a railway cannot change its locomotive fleet costs on a daily basis to respond to changes in traffic volume. However, in the longer term the railway *can* change locomotive costs to traffic level changes: More traffic will cause railways to lease or buy locomotives; less traffic might cause them to sell locomotives or allow leases to expire. In the very long term, every railway cost is variable.

Short-term variable costs refer to costs that vary with traffic volume over a time frame of one year or less. Examples include diesel fuel and electric energy for traction. Short-term variable costs would govern short-term pricing decisions that use surplus resources.

Medium-term variable costs are costs that vary with traffic over a time frame of one to three years. Examples are wagon maintenance, train crews, and leasing of wagons or locomotives. If railways are negotiating medium-term service contracts, the negotiated price should cover at least medium-term variable costs of providing services.

Figure 1 Basic Model Structure



Long-term variable costs vary with traffic volume over a timeframe of three years or more. Examples include capital costs of rolling stock[152] and infrastructure maintenance. This is the cost level that should be used for most pricing and other

[152] Rolling stock ownership is considered variable in the medium term because railways can increase or decrease rolling stock through purchases, sales, and leases. Thus, most SCPM systems calculate an annual capital cost for rolling stock and consider this cost variable in the medium term.

decisions—in normal circumstances, a negotiated price should cover at least long-term variable costs of providing services.

The remaining costs do not vary with the volume of traffic. An example would be some headquarters expenses such as the cost of the financial audit. These costs are referred to as 'fixed' because they do not vary with traffic level and 'common' because they cannot be attributed to specific traffic. In this case, 'fixed' does not equate to 'unchangeable.' Railways can and do alter the size of their headquarters staff or make changes to their track capacity. Often these changes are related broadly to very long-term changes in business level—variable costs in the very long term.

Fully allocated costs include all short-, medium-, and long–term variable costs, plus allocated fixed and common costs. Fully allocated costs are used as a benchmark—if all railway traffic covered fully allocated costs, the railway would be profitable. Normally, some traffic will pay less than fully allocated costs and some will pay more. If each traffic segment pays at least its long-term variable cost, no traffic subsidizes other traffic. The railway is profitable if the sum of the contributions above long-term variable costs cover the fixed and common costs.[153]

Often, railway SCPM systems calculate several cost levels for each service, corresponding to short-, medium-, long–term, and fully allocated costs, as discussed above. This allows users flexibility to use the cost appropriate to the timeframe and decision to be taken.

2.2 Cost Causality

In the SCPM, railway costs are associated with specific traffic movements. Relationships can be established through direct attribution, known cost, expert judgment, or allocation.

Direct attribution

The most accurate way to associate costs with service is to collect the cost separately for each service. The European Union's acquis communautaire[154], for example, requires at least accounting separation between passenger, freight and infrastructure entities so that their costs are accurately. For example, maintenance costs could be collected by locomotive type, which would allow the SCPM system to accurately attribute costs to the services provided by each locomotive type. Detailed information on major cost elements should be collected and used in the SCPM system, wherever possible.

Engineering relationships

Relationships between costs and services can be established based on engineering or statistical analysis. For example, fuel costs are often related to services based on gross ton-kilometers, especially if train speeds and other operating parameters vary little. Another example is track wear, where significant engineering research has been conducted on the relation between costs and use.

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[153] Through a modal policy promoting a level playing field with road transport, governments sometimes subsidize railway infrastructure costs, reducing the need to cover fixed and common costs through margins over variable cost.

[154] Aggregate body of European Union law.

Expert judgment

For cost relationships that cannot be calculated with precision, expert judgment is acceptable. For example, locomotive maintenance experts may evaluate locomotive maintenance as 50 percent variable in the medium term, and the relationship to services is half caused by train km and half by gross tkm. Developing a new costing system may require many expert judgments. Over time, these expert judgments should be tested and revised, and updated to reflect changes in the cost structure.

Allocation of common costs

When full cost information is required, fixed and common costs must be allocated between services, a process that is purely arbitrary. Since there is no right or wrong method, railways use various methods of allocation, including by tons, by ton-km, and as a markup of variable costs. This process is essentially arbitrary.

Cost causality relationships will be defined in terms of physical characteristics, which can be collected for each traffic movement. Examples are shown in Figure 2 below; physical characteristics used to relate costs to traffic are referred to as 'cost drivers.'

Figure 2 Examples of Cost Drivers and Variability

Cost	Physical Movement Characteristic	Short Term Variable Cost %	Medium Term Variable Cost %	Long Term Variable Cost %	Fully Allocated Cost %
Diesel fuel	Gross ton-km	100	100	100	100
Wagon maintenance	Wagon-km (costs separated by wagon type)	30	100	100	100
Wagon ownership	Wagon-hours (costs separated by wagon type)	0	60	100	100
Track maintenance	Gross ton-km	10	50	100	100

3 Structure of a Service Costing and Profit Measurement System

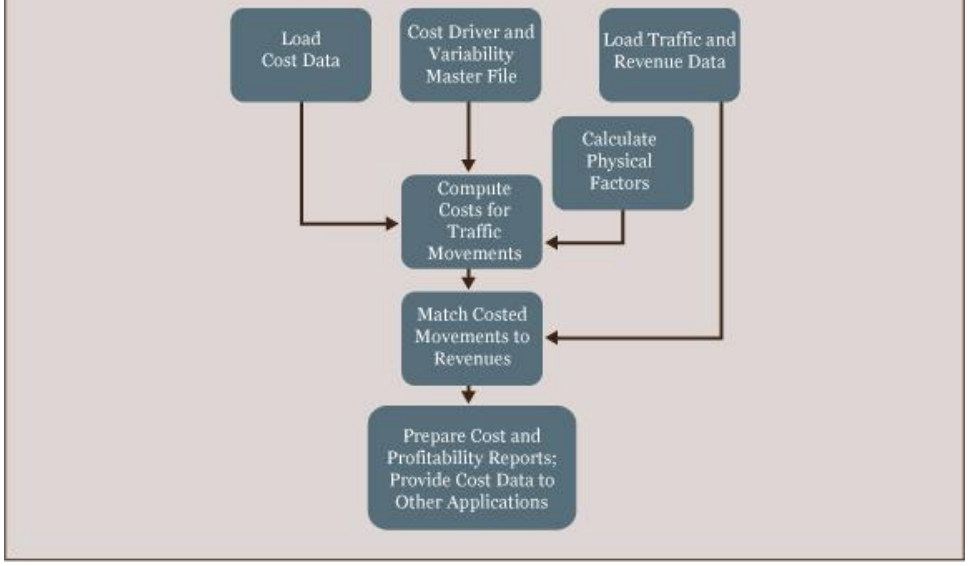
Typically, the SCPM system combines traffic, revenue, physical, and cost data from many railway systems. This includes waybilling or ticketing, revenue accounting, cost accounting, and various operational systems. The basic process is shown in Figure 3.

Traffic movement information comes from railway operating systems that record and track traffic, such as the waybilling system for freight, and the ticketing system for passengers. These systems provide basic movement characteristics—origin, destination, weight, wagon type, and freight commodity, or origin, destination, and service class for passenger traffic. The movement can be matched to operational databases to find the physical characteristics of the movement that correspond to the railway's cost drivers. Examples of such physical factors are the freight movement ton-km, equipment type, and shipment time.

Cost information comes from the railway's cost accounting system (or systems). The quality of the SCPM system output is constrained by quality and detail of cost data available. In a high quality accounting system, a number of descriptors are recorded together with the amount of each expenditure:

- *Functional expense.* For which function was the expense incurred? Examples are train operations, track maintenance, and station operations.
- *Natural expense.* What type of good or service was purchased? Examples include diesel fuel, electricity, rail, ballast, and track labor.
- *Service/profit center.* For which service or profit center was the expense used? Examples are intercity passenger service, merchandise freight, intermodal.

Figure 3 Typical Process for Service Costing and Profit Measurement System



- *Geographic location.* Where was the expenditure used? Geographic location may be defined by routes or line segments (Astana to Karaganda), administrative regions (Northern Division), or specific location (Almaty), depending on the location breakouts of interest to the railway. Often the most specific location identifier is used, and can then be aggregated into broader location groups according to the railway's preferred system.
- *Cost center.* Which organizational unit has budget responsibility for the purchase? Examples are Track Department, Northern Division, Baku Locomotive Workshop, or Accounting Department. In the case of multiple layers of budget responsibility, the most specific identifier is used and can then be aggregated into broader groups.
- *Capital project budget.* Which project? Examples are rebuilding a bridge, or double tracking a line.
- *Customer/Special Service.* Is the expenditure for a single customer? Which one? The customer would be tracked only if significant recurrent expenditures

are made. Examples are unit train service for a coal company, intermodal trains for sea/land services, or special unloading services for a chemical company.

A variability master file is created that defines the physical factor—cost driver—with cost varies and the proportion of the cost that varies at the defined cost level. Costs are associated with traffic by applying the relationships in the variability master file to the physical factors associated with the traffic. This process often contains many layers of decision rules.

Revenue information from the railway accounting system is matched to movement information and costs, using a movement identifier such as the waybill number in both sets of data.

The result is a detailed database that includes traffic information, revenues and costs. This database can be used to generate cost and profitability reports by service type, customer, commodity, line segments and other classifications. The database may also feed other analytical tools, such as tools for estimating costs for prospective movements, based on their physical characteristics.