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ECONOMIC EVALUATION OF FREIGHT CAR (WAGON) MANAGEMENT CONTROL SYSTEMS

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Car and locomotive management control systems can be powerful tools to improve utilization and thereby postpone capital investments in rolling stock and motive power. This note describes how to evaluate the economic benefits and costs of these systems and what can go wrong in reality.

ROLLING STOCK AND MOTIVE POWER MANAGEMENT

In any commercially oriented railway, locomotive and car management are crucial functions in the quest for profitability. Indeed, better utilization of those assets is normally translated into a sizable reduction in the capital investments planned for future years to expand the car and locomotive fleets required to satisfy eventual growth in traffic demand. At any point in time, a railway's inability to make available the cars requested by a shipper, within a reasonable number of days, may cause the latter to divert its shipment to a competitive mode or to another railway. This loss of revenue becomes even more serious when the railway management knows that those cars are available in its system but its car management control functions are not organized to permit a quick response in locating, routing, assigning and placing them promptly at the shipper's siding. Similarly, inability of a railway to provide for adequate and timely motive power required to pull its trains at key points may increase total transit delays and divert shipments of time sensitive goods to alternative modes. Lack of motive power also adds to the dwell time of cars in yards and sidings, decreasing their utilization and, therefore, causing larger fleets and capital investments which the railway can ill afford.

A quick review of the staff appraisal reports for most Bank-financed railway projects in the last 20 years shows that car and locomotive measures of utilization as well as of availability were often used as operational targets. Yet, in most cases, while availability sometimes increased (at least in the short run) through the infusion of spare parts, new workshops and better maintenance practices, utilization of car and locomotives consistently fell short of the targets set at appraisal. In contrast, since the beginning of the 1970s, most U.S. and Canadian railways have been able to reduce drastically their turnaround times and locomotive idle time through a combination of computerized car and locomotive management and a top down philosophy and strategy that interlock the marketing function (from the moment the shipper orders his cars) with the transportation and mechanical functions (which respectively manage the operations and make available the existing fleet for operations). This effort, undertaken in several railways such as the Southern Pacific1/ (TOPS), Burlington Northern (COMPASS), Union Pacific (TCS), Canadian National (TRACS) and Canadian Pacific, revolutionized the railways not only because it increased the productivity of their assets but also because it improved tremendously their service reliability. Indeed, until the introduction of those systems cars were often lost in yards and locating them was very time consuming, car orders were not fulfilled, and transit times were unreliable. These problems increased overall logistics costs because loss and damage, reliability, and inventory costs were high, more than offsetting the tariff which was probably lower than the competing truck tariff. The railways' effort in improving car and locomotive management, in part a response to

this challenge, succeeded in cutting the traffic lost to trucks. But, at least in the two major Canadian railways, the introduction of car management control systems was accompanied by aggressive marketing strategies, reliable traffic costing systems and an exhaustive training campaign to prepare staff at all levels for the transition from manual to computerized systems.

THE CAR MANAGEMENT PROCESS

If car management had to be done manually and without appropriate telecommunications, it would be an almost impossible task. In fact, accounting for more than 10,000 cars of different types in systems with more than 5000 km and several marshalling yards and dozens of industrial sidings, becomes a difficult task which prevents a quick response to shippers' needs and to transport managers' strategies. Fortunately, the progress in telecommunications and in computer technology allowed the design of real time computer systems which facilitate the execution of the car management process. This process consists of the following steps:

- Ordering of equipment;
- Forecasting car demand and supply;
- Planning car distribution;
- Supplying of equipment;
- Monitoring car distribution;
- Monitoring demand for equipment; and
- Post auditing car demand and supply.

The lack of appropriate telecommunication systems in most developing railways, which in most cases had no VHF/UHF systems, prevented the introduction of Traffic Operating and Reporting Control Systems (TORCS). One of the first developing country railways which invested in a system of this type was Ferrocarriles Nacionales de Mexico (N. de M.), which installed an operating control system called TOPS, designed and marketed by Southern Pacific Railways. In other developing country railways, TORCS have been installed successfully, such as the SIGO system at the Brazilian Federal Railway (RFFSA), where productivity improvements in the Minas Gerais and Paraná Corridors were well received by the customers. In other systems such as the São Paulo State Railways (FEPASA), in-house development of the system (TREM) has been plagued by architectural flaws and hardware and telecom limitations and the system is losing credibility in the eyes of the operating staff. This should be avoided in the introduction of any new system by carefully testing and debugging the operating software. The World Bank is financing car management systems in India and Thailand. Malaysia, Pakistan and China have also planned car management systems either with bilateral or multilateral financing, as have many African railways.

This note describes the most common benefits and costs attributed to an operating control system and explains how they can be quantified using an actual case study. The name of the railway involved has been replaced by XYZ. In addition, based on the experience gained in several railways of the industrialized countries, the note suggests common pitfalls in the evaluation of car management systems. This note is intended to add more realism in the evaluation of future car management components of proposed loans. Although continuous improvements in telecommunications and in software languages will tend to make these systems more and more user friendly, the basic evaluation techniques will remain the same.

OPERATING CONTROL SYSTEMS (OCS)

A typical OCS and adequate telecommunications include: (a) a computer component with at least three modules (location of equipment, car distribution and train consists) and (b) a telecommunication component with VHF (which provides for train radio) and UHF (which provides for telephone lines over microwave). Normally, the status quo in most developing country railways is a system with an aging open wire carrier system. Therefore, the economic evaluation should compare the costs of the OCS plus telecom package with its benefits. The telecom system has other benefits far beyond the OCS uses. Following are the benefits which are in general attributed to the OCS plus telecom package:

VHF System (Which Provides for Train Radio)

- Reduction of car delays in yards;
- Improvement of the utilization of yard locomotives; and
- Reduction of damage to cars and locomotives.

UHF System or Open Carrier System (Which Provides Telephone Lines Over Microwave)

- Reduction of car delays through better train operation;
- Improvement of the utilization of road locomotives; and
- Reduction of overtime costs paid to crews.

OCS (Which Includes Computer Systems and Portion of UHF Used)

- Improvement in car utilization due to better car distribution and control; and
- Improvement in yard and road locomotive utilization due to better operating control.

Annex A examines in detail each of those benefits, suggests how they can be evaluated and illustrates what happened with the XYZ Railways by comparing the evaluation done by consultants at appraisal with the reality 14 years later. Although the results shown in the case study are very negative, it is not the intention of this note to discourage the financing of car management control systems. On the contrary, these systems are nowadays indispensable in most freight railways, yet they are not the panacea for poor operations management, poor marketing and lack of traffic demand. The introduction of these systems should be carefully planned, especially insofar as the human factor is concerned.

CONCLUSIONS AND RECOMMENDATIONS

The XYZ Railways case study stresses that the introduction of an OCS/VHF/UHF system with the objective of improving car turnaround times, locomotive downtime and yard operations must be accompanied by a number of institutional and behavioral changes within the railways, without which the apparent savings will not materialize. A "top-down" campaign, preferably carried out by the Railways General Manager, should: (a) prepare the staff for the transition from a manual to a computerized system, (b) ensure that the system is only officially introduced when it is reliable and (c) ensure that the maintenance of equipment will not be neglected. To Bank staff evaluating these systems it is recommended that extensive sensitivity analysis and cost risk analysis tests be undertaken in the economic evaluation of these systems. In general, the first years in which some of the expected benefits materialize come much later than planned, and the development costs are significantly higher than expected.

As the XYZ Railways audit undertaken 14 years after an excellent appraisal indicates, most of the anticipated benefits attributed to the system did not materialize because the context in which the system was operating, and the human element surrounding it, did not provide the enabling environment required to make it work. This only emphasizes that Operating Control Systems are not the panacea for car and locomotive management; instead they are only tools which must be used in a structured framework which sensitizes all levels of the organization to the importance of car and locomotive management with an explicit commitment of the organization to a goal which is measurable and attainable. It is therefore recommended that, when introducing car management control systems, a realistic institutional analysis of the recipient railway be undertaken, focusing particularly on the ability and willingness of its staff to learn new methods and on its capability to maintain sophisticated equipment.

TO LEARN MORE

1. Rebelo, J. 1992. "Preparing Multiyear Railway Investment Plans -A Market Oriented Approach". Policy Research Working Papers, WPS 1006. Washington, D.C. The World Bank.

2. Porter, D. 1988. "Modular Management Information Systems for Railways". Discussion Paper No. 30. Washington, D.C. The World Bank.

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ENDNOTE:

1/ In parentheses we indicate the acronym of their original operating control system.

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