Rail Infrastructure Costs in Hungary[1]

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Abstract: The study aimed providing an independent cost calculation scheme that is not "disturbed" by the self cost calculation prescripted for the IM (Hungarian State Railways) in the act 66/2003 GKM-PM, and at the same time independent from the internal cost calculation process of MAV Co. Fortunately, the MAV Co. possesses a detailed Accounting Management System that supports activity based cost calculations very well. Since all booked values can be split along different dimensions, the flexible evaluation of the accounting system is possible. A further advantage of the system is that activity codes more or less belong to different organisational entities. This means that the majority of IM's activities could be easily selected by choosing the activity codes that belong to the IM. Still, there remained a set of activity codes that had to be evaluated one by one, judging the proportional belonging of the to the IM. Because of the large number of analysed functions and cost data, the manual evaluation was impossible. This is why an appropriate calculation and modelling tool had to be developed, called Extended Activity Based Cost Calculation Model for Railway Infrastructure" (EABCMRI). Using this, functional calculations and sensitivity analysis of the functions become much easier.

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1. Introduction

In order to reach the aim of this study, an accurate data basis that contains the basic cost data had to be found. Unfortunately government statistics about the state owned IM's operational and investment costs were not detailed enough. This is why the company's own cost collection system was considered to be a relatively reliable source of cost data. The MÁV Co. was already aware the fact, that without a proper accounting system the adequate cost and charge calculation will not be possible. Preparation for the new system started already in 1995, but the full and live use of the new Accounting Management System (AMS) started only in 2001. Apart from the technical hierarchy (access to all accounting data via a Web-based application, relatively short answer time of the system, prepared queries according to main controlling and management issues, etc.) the structure of the database is of primary importance.

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All accounting data can be split according to the following dimensions:

1. Corporation code: indicates the partner company that released the bill (of course, not all companies are coded, only main ones, the rest receives the code “other”).
2. Accounting number: the appropriate numerical code that describes the position of the value in the accounting hierarchy.
3. Activity code: there are round 1600 activity codes within AMS that were derived from the main activities of the company. Although the judgement of the proper activity code can be partly subjective, a definite guide helps the work. The activity code is maybe the most important dimension of the accounting process: this helps to attach cost to different activities, are defined at a very low level (already at the level of each payment, let them be negative: cost or positive: income) and therefore support the activity based cost calculation (ABC) that is the most important basis of infrastructure accounting.
4. Organisational code: refers to the organisational part of the company that is liable to the cost or the income. This helps to separate operational and management costs, and to join them to transport volumes (the definition of fixed and variable costs).
5. Track section code: used only in cases where costs or incomes can be directly attached to a definite track section. In this aspect the code describes the distribution of costs according to the geographical layout of the railway network.

Since pre-defined and flexible queries can be made according to different instances, the fixed and variable cost calculation, and the ABC is supported by the accounting system. This is the basis of the cost calculation scheme that is introduced below.

2. Cost and charge calculation model for infrastructure pricing

Based on the possibilities of the multi-dimensional accounting system of MÁV Co. BUTE developed a model (fig. 1.) that ensures the split between fixed and variable cost components, and helps to derive infrastructure charges from the result.

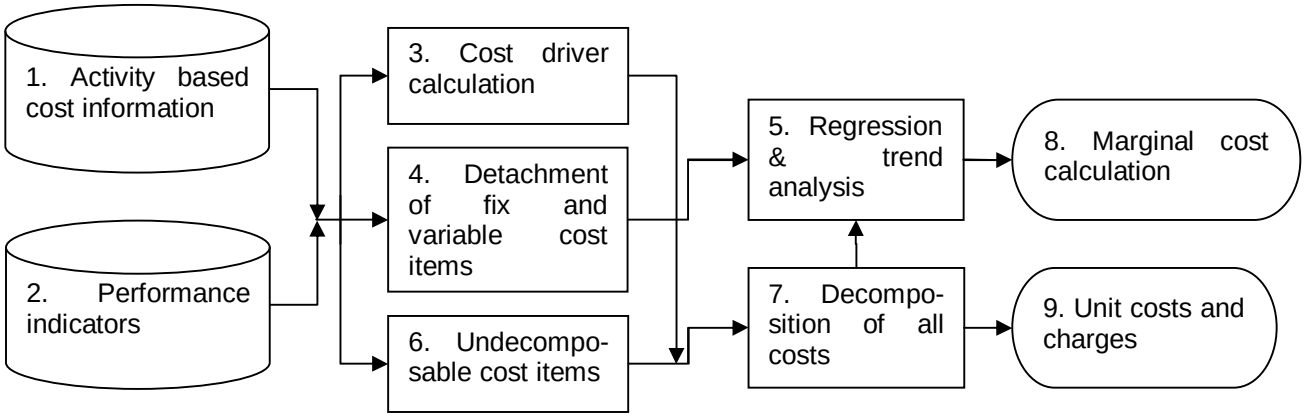

Fig. 1.: Operational structure of Extended Activity Based Cost Calculation Model for Railway Infrastructure

The model was called “Extended Activity Based Cost Calculation Model for Railway Infrastructure” (EAB-CMRI). Its basic operation is shown in fig. 2.

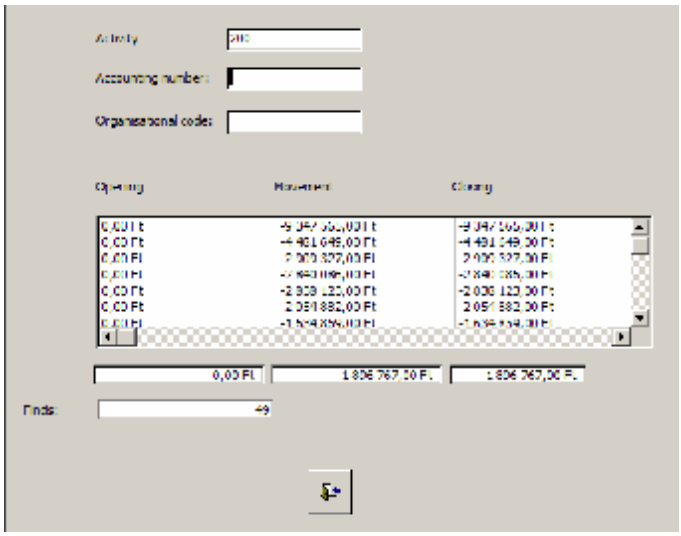

Fig 2. Sreenshot from Extended Activity Based Cost Calculator for Railway Infrastructure

As described above, one of the most important dimensions of AMS is the activity code. MAV Co. introduced 1642 different activity codes that try to cover the full range of the corporation’s functionality. Among these are only those important that are attached to the IM’s operation, and TO’s and other activity codes are indifferent.

The one-by-one examination of all activity codes resulted, that 723 activities are totally or at least partially related to the IM (nota bene: MAV Co was an integrated railway company till the 1st of January 2006, and the examined period ends at this time). This means that the rest of activity codes (1642-723= 919) are related

to other, non IM-related railway transportation activities like passenger transport (e.g. “Ticket selling for passenger trains”) or traction (e.g. “Maintenance of 4 axle diesel engines”). These activity codes can be ignored by the cost calculation of the IM, because are irrelevant for the infrastructure management.

A directed query to the selected activity codes resulted in a moderate size set of data (for five years: 2001; 2002; 2003; 2004; and 2005). This was feed into the model as basis input, indicating those activity codes (239 out of 723) that are only partly belonging to IM’s functionality (like central security, accounting services or some sorts of operating costs of collective used real estates).

3. Marginal costs and unit costs

Marginal costs are received by the derivation of the cost functions. These are huge functions, since originally 679 single cost functions were built up to describe the behaviour of all activity costs (i.e. in average more than 110 functions build up one activity group, among which there are some 4^{th} polynomials, etc.)

Naturally, derivation can be only validated within the actual performance interval. This means that the results are not suitable for analysis that examines the cost structure of doubling or halving the performance. According to sensitivity analysis, the validation interval is ±30% compared to the actual transport performance. Unit costs are much closer related to practical cost calculations than marginal costs. The most important difference (apart from the economic evidence) between marginal and unit costs is that the latter is calculated with the full cost database. Since 44 cost items could not be described by a cost driver, they were excluded from the marginal cost analysis, and this exclusion did not false the results (derivation of the cost function eliminates all fixed-cost-type elements).

4**. Comparison and validation of the results with current official prices**

The act 66/2003 GKM-PM on railway charges and self cost calculation provides the framework of cost calculation procedures and infrastructure charging policies. This act states that infrastructure charges should cover only the direct costs in the case of basic services (under “basic service” train movement and path allocation is meant). The costs of additional services (marshalling/shunting, service for passenger trains) may totally covered by the charges, i.e. also managerial costs that stick to these charges are covered by fees.

This algorithm provides a certain “hole” in the IM’s financing: managerial costs of basic services are not represented in charges. The loss should be compensated by the state, but usually it is not, and the MAV Co has to turn to private financial institutes (banks) to solve its liquidity problems. Still this is no solution for the low level of charges (that, in contrast are too high for some parts of the transportation market from the undertaker’s point of view), and the charges cover only 90-91% of all costs. Official (2006) infrastructure charges are published in the Hungarian Network Statement, an extract of them is shown in Appendix 2.

5. Conclusion

There are some interesting lessons that can be regarded as model-achievements, especially when running the model more times with slightly changed input values (sensitivity analysis). This “learning” can be summarised as follows:

1. Although the railway’s accounting system (AMS) was directly designed to support activity based cost calculations, and separated the cost categories according to this principle, the calculation still has some uncertainties. These come from the centralised activities (that can not be perfectly assigned to separate business branches like the IM or traction); the over-aged definition of activities (the necessary refreshment of the codes should happen in every year, but some years it is postponed or simple not done). A further assignment problem is that the activity codes do not always follow the extents of the costs. In some cases there are activity codes that cover 16 million EUR per year while other only 3-5000 per year. This unbalance might indicate false coupling of real work activities and AMS’s activity codes.
2. State gives very limited flexibility to the IM to calculate its charges. All major steps of self-cost calculation (that is the base of charge calculation) are regulated by appropriate laws. Naturally, this has advantages as well, but at the same time hinders the IM to act as an independent business entity within the economy. The lack of independence has further undesired results: decreasing number of inventions, bad performance-orientation and bad flexibility towards railway undertakings.
3. By using the act 66/2003 GKM-PM, the IM can not reach full cost coverage within its business activities. This is shown also by the fact, that the unit cost calculation of EABCMRI indicates higher unit costs than the current, self cost calculation based prices of MAV Co. This comes mainly from the fact, that basic service prices must not include the proportional share of management’s costs. Even though, alone this

circumstance should not be a problem for the IM itself. The big difficulty is that the state tends to "forget" about the compensation of the railways and this result is a 10-15% under-financing of the IM, which is usually covered by credits from private financial institutes – having a much more expensive financial source.

4. Marginal costs are – according to previous expectations – very low, usually around 10% of unit (average) costs. This predicts that using marginal costs as price basis would need significant external financial sources, or a type of "mixed" price calculation where charges are proportional to marginal costs but closer to average costs. Even if marginal cost based prices would direct the company and the economy towards more efficient using of the society's scarce resources, their introduction is rather a politically sensitive topic, especially because of the high state subsidy that is needed to reach at least close to full cost coverage.
5. Infrastructure-intensive activities (like basic services) have lower marginal costs than work-intensive activities. This complies with earlier analysis of the railway sector as well: where human manpower is needed, the additional cost that stick to an additional performance unit is higher, where no (or only minor) cost is arising when increasing the performance (e.g. depreciation of infrastructure is more or less constant, independent of level of usage).
6. The MAV Co.'s IM is operating far below the optimal performance. According to model calculations, the marginal cost would equal to marginal revenues if the performance could be multiplied by 8 to 14. These numerical results may be rather used to qualitative description rather than quantitative analysis, because they are far out of the proven validity interval of the model. There is no possibility to calculate the "what if" case for 10 times higher performance, simple because no cost and revenue data is available for that performance interval. The reliability of the applied cost functions is only proven by the increase or decrease of the performance by 30%.
7. Not only the high crossing point of MR and MC curves indicate that the IM is operating below the efficient level, but also the results of sensitivity analysis: by increasing the performance, marginal costs are decreasing. This means that additional traffic would cost less than the previous traffic unit, so it is worth to increase transport performance.

From the viewpoint of the railways there is a much more “dangerous” solution available to solve the low marginal cost problem, since not only performance increase, but also capacity decrease would result in relatively higher marginal costs. In this interpretation, the railway in not utilising the assets of the society (state) optimally, therefore a withdrawal should take place. In other words: the available assets of the railways are too much to produce such a small level of performance, therefore an asset decrease should happen.
To derive direct actions like this only based on the micro-economic evidence can result in further discrepancies; therefore any asset withdrawal must be carried out extremely carefully, not to harm the existing traffic or the traffic security. This is why this “solution” is not really promoted by any scientific advisors, or government institutes.

The study had the aim to provide an independent cost calculation scheme that is not “disturbed” by the self cost calculation prescripted for the IM of the Hungarian State Railways in the act 66/2003 GKM-PM, and at the same time independent from the internal cost calculation process of MAV Co. Fortunately, the MAV Co. possesses a detailed Accounting Management System that supports activity based cost calculations very well. Since all booked values can be split along different dimensions (not only the account number, but also geographical, organisational and activity codes), the flexible evaluation of the accounting system is possible. A further advantage of the system is that activity codes more or less belong to different organisational entities. This means that the majority of IM’s activities could be easily selected by choosing the activity codes that belong to the IM. Still, there remained a set of activity codes that had to be evaluated one by one, judging the proportional belonging of the to the IM. Because of the large number of analysed functions and cost data, the manual evaluation was impossible. This is why an appropriate calculation and modelling tool had to be developed, called Extended Activity Based Cost Calculation Model for Railway Infrastructure” (EAB-CMRI). Using this, functional calculations and sensitivity analysis of the functions become much easier.

Functions are only available if a proper independent variable (cost driver) can be found. Since accounted costs were available from 2001 to 2005 (5 years), the appropriate performances (that are used as cost drivers or independent variables in functions) had to be collected as well. These were obtained from different internal statistic sources of MAV Co. The accounting database was downloaded and stored in a Microsoft Access database.

When having all accounting and performance data available, the regression analysis started by finding the appropriate independent variable while looking at the co-relations between the analysed data parts. Naturally, different activities have different cost drivers. If we want to reach a bit higher reliability, multi-dimensional functions have to be used to describe the cause-effect relation between the independent variable and the cost driver.

With functions “in hand” the cost analysis was started. Firstly, the fixed costs had been calculated by extrapolating the function till the independent variable becomes zero. Afterwards the unit cost (average cost) calculation was carried out. Later the derivation of the functions had to be made in order to obtain marginal costs.

Since both unit and marginal costs are expressed in performance units (like EUR/vehicle km), they can be compared with actual Network Statement values. This comparison needed the proper equivalence algorithm, because the types of cost calculations (the one with EABCMRI and the act-based MAV Co. self cost calculation) used partly different activity groups.

Comparison of calculated values with NS prices comes out with some interesting results:

1. NS values are below the corresponding costs, therefore the company can not reach 100% cost coverage ratio.
2. Work-intensive activities have relatively higher marginal costs than infrastructure-intensive activities.
3. Marginal costs are around 10% of average costs.
4. Marginal costs are decreasing in the actual performance interval.
5. The IM is working far below the optimal output; this means a bad utilisation of the available assets.

The comparison results were then summarised as learning with the help of the model, with exclamation mar for not drawing bad conclusions regarding IM’s assets.