Asset management for the Dutch railway system

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Abstract

I. INTRODUCTION

Over the past decades, many infrastructure related management organisations have transferred from separate investment management and management and maintenance to a more integral asset management. Asset management is expected to optimise cost-effectiveness of infrastructure management. This paper will explore asset management in practice and serves as a first step of an in-depth research of asset management.

Asset management is a broad concept, applied in many different branches. To be able to do this exploration, it is therefore important to define asset management the way we intend to use the concept in this research. The Institute for Asset Management[1] defines the concept as: "systematic and coordinated activities and practices through which an organisation optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organisational strategic plan"[2]. The main characteristic compared to other management approaches is the integral approach to the assets to be managed. Not only are investments in assets assessed on the basis of their whole life cycle rather than the unique investment of acquisition, but these investments are also related to the benefits of the assets for the functioning of the whole system of assets in its provision of service to society. With this approach, optimisation in system and contract management can be obtained.

In this paper we will explore how asset management is being applied in the management of the railway infrastructure in the Netherlands, a country with one of the most densely used railway grids in the world. The question we intend to answer is how the above described intention works in a bit more detail. To this end, we use a few sub-questions: How is the Dutch railway system management organised? How does asset management fit into this? And what are the goals and strategies used in the management of assets in the railway infrastructure system? We will also dig into the subject a bit deeper by analysing what contracting practices contribute to asset management, given the contingencies resulting from the specific socio-technological characteristics of the Dutch railway system, as well as the challenges the asset managers face.

This article is based on interviews with four asset managers[3] at ProRail, the manager of the Netherlands' main railway network. The research is intended to become much more extensive and there is a purpose of comparing the results with asset management practices in other sectors, such as energy, road management and water supply.

II. ORGANISATION OF THE DUTCH RAILWAY SYSTEM

Since Dutch rail transport services were privatised in the 1990s, Dutch Railways was split up in several companies, with as its main successors the core company and public transport operator NS (Nederlandse Spoorwegen = Dutch Railways) and ProRail, the successor to NS Rail Infra Management, Railned (capacity management) and NS traffic control. Railway infrastructure manager ProRail became a subsidiary to central government's ministry of Transport and Water Management.

NS has become a private transport operator, which still remains state-owned, and saw competitors entering the rail transport market. The Dutch railway network was divided in a core grid (the most important connections between the largest population centres), for which NS acquired the concession, and peripheral lines. The latter were tendered in separate concessions and these contracts have been won by several other companies. ProRail manages the rail infrastructure of both the core grid and the peripheral lines. NS is by far ProRail's most important customer, due to the large size of the core grid as compared to the peripheral lines. The latest additions to the Dutch railway infrastructure are managed a bit different from the core and peripheral lines, however. The

[1] As sponsor of the widely used PAS 55 framework for asset management, The Institute for Asset Management is the main international forum on this issue.

[2] The Institute for Asset Management at www.theiam.org, retrieved June 17, 2010.

[3] The respondents were: Mark Beuk, staff member of Infra Operation; Joeri van Holsteijn, programme manager Project Innovation; Ted Luijten, manager expert group Maintenance management and Jeroen van Veldhuizen, tender manager of large projects and maintenance.

high speed line South (Amsterdam to the Belgian border) and the Betuwe Route (a dedicated freight railway line from Rotterdam to the German border) have designated infra managers.

The work of ProRail can be described as strategic capacity management and consists of construction of new rail infrastructure, maintenance of the existing rail infrastructure, for which it hires contractors to do the actual works, and traffic control. All the systems needed for this service, such as railway tracks (2800 line kilometres, 6830 kilometres of tracks), tunnels and viaducts (5100), overhead wiring (4500 kilometres), switches (7508), signalling system, safety control system, stations (388) etcetera, are the assets that ProRail manages. It accommodates some 16 billion train passenger kilometres annually and has approximately 1.2 million passengers daily. The total annual number of train movements mounts to 3 million.

ProRail's main task is to provide infrastructure availability to transport operators. The market is defined by demand and supply of rail path availability. Both transport operators and ProRail's maintenance requirements are competing for availability in this market.

A. ProRail's Organisation

ProRail has four task divisions: Transport and timetables, Operation, Projects and Finance. The Finance department is not particularly relevant for this study. Transport and timetables consists of the branches Capacity allocation, Account management passenger transport, Account management freight transport, Transport analysis and capacity development and Traffic information and station services. Operation covers the tasks ICT services, Traffic control and Asset management. Projects contains the branches Relational management, Project development and implementation and Acquisition, conditioning and innovation.

Particularly important for this study is the distinction between the activities of the Projects department, which concerns newly built infrastructure, and Asset management (part of Operation), which concerns the management and maintenance of existing infrastructure.

B. The Asset Management Department

The Asset Management department is responsible for safety, availability and reliability of the infrastructure. It facilitates small-scale maintenance and disturbance dispatch. It has a budget of some 280 million Euros and a staff of some 1600. The department has three branches: infra systems (makes rules and frameworks for safety systems and the rail infrastructure, i.e. the tracks), infra information (data systems) and infra planning (preparatory engineering). The latter also provides services to the Projects department.

The Asset Management department is responsible for maintenance for which no engineering is required. If it does require engineering it becomes either large-scale maintenance or function change.

The Asset Management department of ProRail works with five certified contractors, of whom four are currently active in the tendering market: Strukton, BAM and Volker were the original contractors for railway maintenance works. There even was a distributive code (50, 30 and 20 percent respectively). This was a matter of truck system, because the companies had invested in the required knowhow. A few years ago, this policy was abandoned. Recently ASSET Rail, a joint venture of Dura Vermeer and Arcadis joined the three. Spitzke is the fifth certified contractor and the only one from abroad (Germany). As of this moment it has not won a tender yet, however.

III. CONDITIONS OF THE MAINTENANCE WORKS

Conditions of maintenance work on the rail infrastructure are strictly regulated, predominantly for safety reasons. Entering the tracks requires a number of procedures that make it impossible to execute quick repairs. Because of this, maintenance work is an important competitor of transport operators for the scarce capacity on the tracks.

A. ProRail's ambitions and activities to achieve them

ProRail uses four performance criteria for the management of its assets: safety, availability, sustainability and reliability. ProRail aims at zero casualties among rail road workers, a fifty percent growth of the number of travellers in the 'extended Randstad' (the region where most people live and the railway system is used most intensively), twenty percent lower life-cycle costs per train kilometre and an eight on ten mark from customers (transport operators) and ProRail's environment.

The asset managers'daily work is to create an optimal availability balance that is determined by three limitations: costs, safety and system engineering. Safety allows no trade-offs and budget availability to cover costs are largely externally defined. As a result, the asset managers' manoeuvrability lies in being more efficient, which is predominantly obtained through system engineering. With the help of this system engineering ProRail hopes to improve its performance.

The works are done both day and night. Limitations during the day are the intensity of traffic operations. The limitations during the night are the labour regulations. The intensive use of the railway capacity on the network limits flexibility throughout the day. The safety procedures require an interval time of about a quarter of an hour between two trains to enter the tracks for the smallest repair (such as removing a small obstacle that jams a switch). This makes the vulnerability of the railway system for disturbances very large. Almost all disturbances will bring service to a halt.

These limitations have incentivised ProRail and its contractors to find new solutions. Probably the most illustrative example is the video observation train. This is a train with an 'open' floor that is equipped with lots of machinery that enables workers to check the status of the railway track without the need to enter the tracks unprotected (which would require a service interruption). The video observation train will automatically occupy a track for the time it requires to execute the checks and does not require lengthy and elaborate procedures to allow workers to do their job.

B. Efficiency

ProRail intends to introduce different infra concepts to introduce differentiation in its railway network. This way, it will be able to optimise its means. The Dutch railway network consists of lines with very dense traffic, but there are also lines with a more modest usage. The latter require less investment in, for instance, maintenance or assets (such as switches). With these infra concepts, ProRail will create tailored service.

C. New contracts

An important part of the optimisations is to be achieved by using new contracts. ProRail has been used to maintenance process contracts, in which ProRail gave maintenance contractors clearly defined tasks for all works on all applicant susbsystems. This does not exact a good performance from the contractor. Theoretically it even includes the perverse incentive that the contractor might benefit from bad maintenance to, for example, a switch, because it would require ProRail to have the contractor replace the switch, which is a more costly work.

Recently, however, ProRail as adopted a new kind if contract: the performance based contract. These new contracts put more risk on the market, but also offer more opportunity for efficiency innovations. ProRail oversees the work of contractors directly on the basis of its own strategies: safety, availability, sustainability and reliability. The contractor has much more liberty to organise maintenance the way he thinks is most efficient for him, as long as he will perform in accordance with the performance criteria formulated by ProRail. In practice it appears that contractors that have a performance based contract use significantly less time for maintenance than contractors in a maintenance process contract, although the contractors are still the same.

IV. ASSET MANAGEMENT CHALLENGES AND THEIR IMPLICATIONS

One of the philosophies behind the asset management efforts of ProRail is the approach of the system as a whole, rather than as an assemblance of components. This can for instance be seen in the current trade-offs on the position of switches as part of the railway system. Switches do not only require an initial investment, but will cost money throughout their life cycle. Maintenance on switches is relatively expensive. This could be a valid reason to limit the number of switches. However, switches do provide the opportunity to change tracks and, for instance, bypass a service interruption. Asset management is then no longer a matter of trading off one asset against the other, but rather a matter of trading off how each asset can contribute to optimisation of the whole system in terms of, most particularly, efficiency. In other words: to obtain the highest functionality value (in terms of safety, availability, sustainability and reliability) against the least possible costs.

A. 'Line of sight': how to provide oversight?

An important assignment for ProRail in the new contracts is that its strategic goals are so concrete that one can know on the level of actual activities to which strategic goal they contribute. The new performance based contracts do have the hazard in them that ProRail as a client will lose proficiency, because the requirement of knowledge moves from ProRail as a system specialist to the contractors. But ProRail will still have to assess to what extent contractors meet the performance criteria. Moreover, a reduced sight on th actual system would make flaws overlooked more easily. To prevent such developments, ProRail wants to make sure that enough information on the system remains available to its organisation and that there are people who can actually assess this information. To this end, ProRail intends to develop an information system, so that valuable knowledge of its assets will not remain a private matter. This will quantify information. It acknowledges, however, that it is still an issue that requires attention. To assess the information, ProRail will keep inspectors involved, who will be out in the field checking the tracks. They should be railway engineers who have the same knowledge as the contractor's engineers. This will add qualitative information to the system too.

B. Risk management

The mentioned 'line of sight' will be steered with risk management instruments. ProRail will use this to make trade-offs visible to managers and even government actors. Trade-offs should include the expected implications on the risk that strategic targets will not be achieved. This requires estimates about risks of long-lasting unavailability, high costs, safety hazards etcetera. The purpose of these risk estimates is to pre-establish the level of acceptance.

In the winter of 2009-2010, for instance, railway traffic in the Netherlands was severely disturbed because of a long period of snowfall and cold. As a consequence, service on many routes had to be halted because switches were frozen and did not function. Nationwide dissatisfaction occurred, among both citizens and politicians. An often heard complaint was that the Dutch railway system became dysfunctional after some snowfall and cold, while countries such as Sweden and Switzerland, with more frequent and considerably heavier winter conditions do manage to keep their trains running. The Netherlands can also manage to keep trains running, but this will for instance require investment in switch heaters; an expensive investment that may be worthwhile in Switzerland, but it would be questionable whether an equal investment would be sensible in the Netherlands, where such conditions occur much more rarely. Management of assets would thus be served with these kinds of risk assessments. It makes clear to what extent investments are efficient and where strategic goals may not be met. Here lies a use for information systems too. So far, the information systems only include information about disturbances, but information on these kinds of risks should also be available, so that trade-offs on the system can be objectified.

C. Problems and obstacles

A few situations still stand in the way of successful implementation of these asset management instruments. First, internal fragmentation within ProRail hampers the assemblance of the required information for such objectification. This makes ProRail relatively weak in negotiations with central government institutions. They may lay too heavy and/or competing demands on ProRail's services. After all, society wants ProRail to minimise expenditure and in the mean time invest in better availability and reliability of the system.

Second, ProRail makes the costs of which other actors, namely the operators or society as a whole, benefit, through better service that result in more income through a growth of the number of passengers (operators), more sustainable transport, economic gains (society) etcetera. This makes it difficult for ProRail to objectify the benefits of investments.

Third, intellectual property is an issue. ProRail knows from the biddings when a contractor has found an innovative away to achieve better practice and knows it would be beneficial if this innovation were applied in other contracts too, but it cannot inform the other contractors about it. The innovating contractor attains a competitive advantage, after all. Even though it would, from a competition point of view, be better for ProRail as client if the contractors compete on this innovation too.

Fourth, there are interfaces with other networks. In this case, the interface with the rolling stock is particularly relevant. But since the old NS organisation was cut into pieces, the asset managers of one network cannot optimise their assets in coherence with the other networks. An example is most illustrative. A weekly passing ore train passes through several switches near the Eindhoven railway station on its way to Germany. Switches do not suffer so much from regular intercity trains, but they do from these heavy ore trains. From a maintenance point of view, it would be better to use a different train path that puts less strain on the switches, so the contractor bidding for maintenance at this section suggests a discount in case a different train path is used. But the current law does not enable this, because ProRail must provide rail capacity as a service and the transport operator does not feel the urge to consider switch maintenance. This is also seen in another example. ProRail strives for hard steel for its rails to limit the negative effects of wear. But harder rail steel implies that more wear occurs at the train wheels. This incentivises the train operators to harden the steel of their wheels too, which brings the two asset owners in permanent race for the hardest steel. It could be logical to make the contribution from depend on the amount of wear on the rails, but in practice this is hard to achieve. There is political opposition against an increase of the contribution, because operators such as NS would transfer the additional costs to the travellers, which implies an increase of ticket prices. Attached to this, are several societal interests, such as a more environmentally friendly modal split.

V. BENEFITS OF ASSET MANAGEMENT

So where lay the benefits of the new asset management policy? There are two main effects. First, a considerable reduction of maintenance costs has been achieved. ProRail regularly incentivises its contractors by offering money if a contractor can extend the life time of a switch, for example by good maintenance. Such expenditure weighs very well against lower life cycle costs. So far, ProRail has managed to reduce the costs on switches with some 15 to 20 percent. Moreover, prior to the introduction of performance based contracts, maintenance costs had increased by a factor two and a half. This cost growth has been restrained ever since and maintenance costs are decreasing now.

This cost reduction is partly related to the second positive effect. The capacity of the railway infrastructure has increased. The Railway Law requires commercial trade-offs of maintenance and operation. There have been regular clashes of ProRail with operators about, predominantly, activities in the borders of the night, where ProRail's normal five and a half hour halt of operation for maintenance purposes conflicted with late train services. The Railway Law would require a trade-off in which the operator of the late service has to show that this service is commercially more important than the maintenance service, but practice has not reached so far yet.

Meanwhile, however, ProRail has achieved success in incentivising bidders for maintenance contracts to reconsider the required time for maintenance work. The five and a half hours were still based on the time it takes to replace a frog in a switch, which is only done once in some eight years. A few measures are the basis of this success. First, ProRail stopped prescribing activities, frequencies and required implementation time. It formulated requirements on the allowed percentage of track availability for maintenance purposes. Second, the work force entering the infrastructure checks all subsystems parallel, rather than spending one night on tracks, the next on wiring etcetera. Third, maintenance is now done proactively, based on FMECA[4] analyses, rather than reactively on the basis of inspections. The FMECA analysis predicts the wear of the systems and the time after which parts have to be replaced. This makes maintenance works more of a computer job than on-site inspection (without replacing it completely, by the way) and optimises schedules. It turns maintenance from repairing to upkeep that prevents repairs. There are contracts in which scheduled maintenance in a section went down from 52 service halts annually, to a mere six.

[4] Failure Mode, Effect and Criticality Analysis.