Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 10 (2015) 564 – 573

Transportation Research Procedia

www.elsevier.com/locate/procedia

18th Euro Working Group on Transportation, EWGT 2015, 14-16 July 2015, Delft, The Netherlands

A qualitative model to evaluate the financial effects of innovations in the rail sector

Dirk Bruckmann[a,*], Axel Bomhauer-Beins[b], Ulrich Weidmann[b]

[a]*Hochschule Rhein-Waal, Faculty for Communication and Environment, Friedrich-Heinrich-Allee 25, 47475 Kamp-Lintfort, Germany*
[b]*ETH Zurich, Institute for Transport Planning and Systems, Stefano-Franscini-Platz 5, 8093 Zurich, Switzerland*

Abstract

Up to the 2000s, European railway undertakings were integrated companies covering all elements of the railway system. As a result of the European railway packages these incumbent companies were subdivided into infrastructure managers and railway undertakings. The competition in the rail sector and the changing markets encouraged new companies with completely new business models to enter the railway market. New regulations generated entirely new roles and this is why nowadays a lot of companies with very different business models are active in the railway sector. These companies cover different parts of the value chain and have internal as well as external interfaces. Thus, a new model to evaluate funding models under these changing boundary conditions is essential. The authors developed a new role model to describe internal and external financial flows in the rail sector focusing on the financial issues of innovation. Initially all roles in the railway sector were defined and described. A role is the smallest not further divisible function in the railway system. Each role assigns to one field of the railway sector (infrastructure, service provider, operations and rolling stock) or to the external field called environment. A single company can cover multiple roles within the railway system and the former state railways with their wide product portfolio now cover numerous roles in the new railway system. The next step was to evaluate the relationships between the stakeholders within the system and to show the resulting financial flows within the railway system. The role model allows to illustrate the internal flows of a company (e.g. within integrated railway companies) as well as external flows between different undertakings. The model does not differentiate between the supply of rolling stock by internal divisions or by rolling stock leasing companies for example. As innovations usually tackle the economics of more than one role in the system, the model clearly allocates the qualitative economic effects of the innovations. The illustration of the financial flows allows to derive compensation models between the roles gaining profit from an innovation and the roles which lose profitability. The model also allows a rough estimation of the transaction effort for the compensation models. Finally the authors proofed the applicability of the model in three case studies.

* Corresponding author. Tel.: +49-2842-90825-246
E-mail address: dirk.bruckmann@hsrw.eu

Peer-review under responsibility of Delft University of Technology
doi:10.1016/j.trpro.2015.09.010

These case studies demonstrated that one of the mayor obstacles for innovation in the railway system are the missing direct financial flows between infrastructure and rolling stock.

Peer-review under responsibility of Delft University of Technology

Keywords: railway; innovation; funding; role model

1. Innovation in the railway sector

Up to the 2000s, European railway undertakings were integrated companies covering all elements of the railway system. As result of the European railway packages these incumbent companies were subdivided into infrastructure managers and railway undertakings. The competition in the rail sector and the changing markets encouraged new companies with completely new business models to enter the railway market. The new regulation generated entirely new roles in the railway sector which resulted in the fact that nowadays lots of companies with very different business models are active in it. (Hilmola et al., 2007, Weidmann and Nash, 2008). These companies cover different parts of the value chain and have internal as well as external interfaces.

Thus, a new model to evaluate the effects of policy measures and innovation funding models under these changing boundary conditions is essential. The authors have developed a new role model to describe internal and external financial flows in the rail sector focusing on the financial issues of innovation.

2. Existing financial flow models

Most existing financial flows models, respectively cash flow models, show the classical view of a single company. These models work on the basis of the company's accounting and the main goal is to assign cost to cost items and activities (e.g. Navon, 1995, Francis et al. 2000) Other models are mentioned in literature, see for example Hendrickson et al. (2008), which show the cash flows during the life-cycle of a product. Thus, these types of models describe the cash flows on a very detailed basis and do not provide an overview of an entire economic sector.

For the economic assessment of investments in the railway sector, Wheat et al. (2014) summarized different methodologies in their book contribution. The approaches mentioned are also applicable to evaluate the overall feasibility of innovations. The view on the input and output of railway systems, the productivity analysis and the measurement of technical or cost efficiencies only deal with the entire railway system or, if the investment or innovation is only related to one specific sector, with the effects on this sectors. The methodologies described can neither depict the effects on a single company nor the interactions between different companies.

Most of the other assessments of the efficiencies of railways (e.g. Oum and Yu (1999), Lan and Lin (2006)) analyse the railway performance using data envelop analysis. Cowie and Riddington (1996) compare the different results of statistical assessments of railway efficiency. Depending on the type of assessment and the assessed performance indicator, large differences in result apply. So the relative "percentage of efficiency providing services 1992" in Demark varies from 59.51 to 100, depending on the methodology used. Thus, these statistical approaches are not very reliable in general.

Canto, Pastor et al. (2010) analysed the impact of the liberalisation in European railways on innovation. The assessment was based on a statistical approach using the Malmquist productivity index. They concluded that the entire European rail sector became more innovative, but they did not asses, under which boundary conditions innovations in railway are successful and which boundary leads to a failure of the innovation.

All models described are based on a correlation between productivity and different internal and external input factors and boundary conditions. But "correlations simply identify relationships, they do not indicate causality" (Jackson, 2008). Thus, these models are not suitable to evaluate the causalities for the failure of innovations.