Journal of Rail Transport Planning & Management xxx (2015) 1–16

Contents lists available at ScienceDirect

Journal of Rail Transport Planning & Management

journal homepage: www.elsevier.com/locate/jrtpm

European freight rolling stock fleet size in 2050 in light of the Transport White Paper 2011

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ARTICLE INFO

Article history:
Received 6 May 2015
Received in revised form 11 September 2015
Accepted 12 September 2015
Available online xxx

Keywords:
Rolling stock
Rail freight
Competitiveness
Modal shift
Europe
2050

ABSTRACT

The European Transport White Paper 2011 sets high modal shift targets from road freight to rail 50% by 2050. The objective of this paper is to determine the rolling stock fleet size and type up to the year 2050 and associated challenges for stakeholders. Considering the White paper targets, three scenarios are considered; a) Business as usual or Reference Scenario – extrapolation of current trends without major policy change; b) White Paper 2011 Low Scenario (WPL) based on a partial implementation of the modal shift targets and c) White Paper 2011 High Scenario (WPH) based on the full implementation of modal shift targets. To determine the future fleet size, the current paper also conducts a sensitivity analysis assuming 60% productivity level as a base line. The study finds, among others, that significantly more rolling stock (in particular flat wagons, covered wagons and covered hopper wagons) as well as improved asset utilisation will be vital to facilitate the transport of increased freight volume. A unified rail freight system starting with nine Rail Freight Corridors and cooperation among the rail freight operators, wagons manufacturers and companies involved in leasing and hiring wagons will be very important to achieve the modal shift.

1. Introduction

The composition of freight transport chains in Europe has been changing in favour of road transport (Jackson et al., 2014) due to changes in production and consumption pattern (Hesse and Rodrigue, 2004; Islam et al., 2013). Factors such as internationalization, globalization, online shopping and home delivery and information systems (Den Boer et al., 2011; Hesse and Rodrigue, 2004; Meixell and Gargeya, 2005; Park et al., 2009; Törnquist and Gustafsson, 2004; Woodburn, 2007) have intensified this trend in last two decades. The effect of these factors is that the share of road freight has increased from 67.4% in 1995 to 71.6% in 2012 in terms of inland modes in the EU-28 countries. During the same period the share of rail freight has declined from 20.3% to 17.2%. The downward trend for rail freight share began in 1970. Similar trends can also be observed for international rail freight transport services (European Commission, 2011, 2014b; SCI/VERKEHR, 2014; Törnquist and Gustafsson, 2004). Flexibility, reliability, customer tailored and door-to-door service characteristics are behind the successes in the road freight transport sector (Islam and Eidhammer, 2015; Jackson et al., 2014). An efficient and effective freight

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http://dx.doi.org/10.1016/j.jrtpm.2015.09.001
2210-9706/

transport system, with alternative options in terms of service offerings and modes, is an important element in building a fit-for-purpose logistics system in a country or region (Bärthel and Woxenius, 2004; Boyer, 2014; European Commission, 2011; Houldin et al., 2012). Within the freight transport domain, rail freight transport makes an important contribution to economic prosperity. In particular, its perceived environmental friendliness, and energy efficiency, ensures that it is within the focus of policy makers who would like to see rail play a greater role in European transport than it currently does (European Commission, 2011; International Transport Forum, 2013; Reis, 2014).

An important aspect of rail freight transport is the terminal-to-terminal offering which is a segment of a total transport service, offering complete door-to-door services involving multiple modal transfers and typically requires road haulage. In many cases the result is that rail freight services are unreliable and unattractive (Den Boer et al., 2011; Krüger and Vierth, 2015). The unreliability comes from its operational nature, status and response to modern logistics and supply chain demands. Until recently most of the rail freight operators in Europe were government owned and operated and in some instances this is still the case. These incumbents, larger than the private operators, have been operating fleets of rolling stock that are old with large parts of the fleet unaccounted for and/or in a dilapidated condition (Zunder et al., 2012; Zunder et al., 2013).

The European Union (EU) Transport White Paper 2011 has set targets to significantly increase the use of rail freight transport in the future. In doing so, the White Paper aims to achieve a modal shift of 30% from road, to more sustainable modes such as rail, short sea shipping and inland waterways, by 2030 and a 50% shift by 2050, for distances greater than 300 km (Den Boer et al., 2011; European Commission, 2011). Den Boer et al. (2011) reports that 50% of road freight transport haul distance is longer than 350 km. They also suggest that 60% of the European freight market share (in tonne-km) is over 300 km. Bärthel and Woxenius (2004) suggest that intermodal road-rail service works best in freight transport markets for large flow over long distance. The break-even distance of competing transport modes varies (Lu and Yan, 2014). Due to the increased time required for rail freight transport modal transfers and the associated cost, risk of loss, damage and delay (Bärthel and Woxenius, 2004; Danielis and Marcucci, 2007; Yeo et al., 2008), the most cost-effective operations for rail freight services typically require a longer distance.

Cargo type and transport haul (distance), amongst others, are important determinants in terms of selecting transport mode options. This is due to necessary modal transfer that involves extra time, cost and risk of loss or damage to goods for an origin-to-destination transport service (Islam, 2014a). To offset this extra cost (and time & risk) element, a longer transport haul is considered to favour rail and waterways transport, although a previous study suggests that road freight transport is effective in many cases for distances up to 500 km (Jackson et al., 2014). They argued that the operation of rail freight services in a faster and more frequent nature allows rail to be competitive over distances of 200 km or more for low density, high value (LDHV) goods. With the white paper policy targets in mind, a recent study (Islam et al., 2015) was conducted to better understand the impact of these objectives in terms of forecast freight volume. The study assumed three scenarios: a) business as usual (do nothing or Reference); b) partial implementation/achievement and c) full achievement of the modal shift targets. In line with policy implementation and freight forecasts an efficient and effective rail freight transport system will need, among other things, an appropriate infrastructure, skilled operational management and an appropriate vehicle fleet size.

The objective of this paper is to identify the future requirements for rolling stock in 2050, for the EU27, through exploring the current state of the rolling stock fleet and its productivity level. The paper also gives thought to the challenges facing stakeholders of European railways. It identifies the challenges derived from the significant increase in rolling stock forecast resulting from various levels of white paper policy implementation, detailed in Section 3.

Section 2 of the paper presents a literature review of rail freight transport competitiveness and productivity. This is followed by a discussion on the research approach in Section 3. Section 4 determines the current fleet size of European rolling stock using data from a variety of sources including: European (Eurstat) database (in Section 4.1); Railway Directory (in Section 4.2) and DNV (Det Norske Veritas) Report (in Section 4.3). Section 5 estimates the future rolling stock fleet size and describes: rolling stock forecast assumptions (Section 5.1); fleet size determination approach (Section 5.2); determination of fleet size without changes in productivity level (Section 5.3) and a sensitivity (higher or lower productivity levels) analysis examining the impact of increased productivity (Section 5.4). Section 6 determines future wagon typology including wagon type requirements in 2050 (Section 6.1) and the trend of rail cargo units in Europe (Section 6.2). A Summary (Section 7) is followed by Conclusions in Section 8.

2. Literature reviews on freight transport competitiveness and productivity

A number of studies including those by the (Community of European Railway and Infrastructure Companies, 2014a; Luis Ferreira and Murray, 1997; K+P Transport Consultants and Fraunhofer ISL, 2011; Pulfer et al., 2014; Salehi et al., 2009) suggest that increased productivity, using longer, faster and more frequent trains, will be one important way to increase rail's competitiveness.

Morlok et al. (1995) believe that productivity in transportation refers to the ratio of transportation output to input or, in order words, the ratio of transport service output to the cost of providing the service. They also suggest that output can be measured in a variety of ways (e.g. total number of shipments delivered, the total tonne-km carried etc.). For the current research, the productivity of rolling stock is referred to in terms of its effective operational utilisation against availability over a period of time (e.g. year) and/or the extent of utilisation (i.e. how full or loaded is the rolling stock) while in operation.

Please cite this article in press as: Islam, D.M.Z., et al., European freight rolling stock fleet size in 2050 in light of the Transport White Paper 2011, Journal of Rail Transport Planning & Management (2015), http://dx.doi.org/10.1016/j.jrtpm.2015.09.001