The limits of railway transportation in a mass consumption society

Germany, 1900–1938

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Introduction

Freight traffic is fundamental to the functioning of a mass consumption society. The railway was the most important carrier in long-distance traffic until 1920, when delivery vans and trucks started to handle short and long-distance freight haulage.

This paper presents various factors to explain the rise in road freight, which is put in the context of a mass consumption society. It examines German railway logistics, and shows how its limitations gave rise to road freight logistics. The term logistics means, in this context, the basic functions of transportation, of trans-shipment and storage of goods, as well as the intelligent control and supervision of these operations in order to guarantee profitability and quality of operations.[1] This paper is based on the evaluation of trade journals, national statistics and various archives, including the archives of the Chambers of Industry and Commerce in Cologne, Leipzig, Munich and Darmstadt, the state archive in Berlin and the federal archive in Berlin.

The diffusion of road haulage

Until the beginning of the twentieth century, the railway had been the most important carrier for the transportation of people and goods. With the rise of the automobile, new carriers entered the market: automobiles and buses created new possibilities for passenger transportation, and the road motor truck took over this role for goods traffic. At the same time, automobile technology improved, resulting in a decrease in the cost of production. Society, as well, conformed to the new requirements of traffic.[2] By the 1920s trucks were playing an important role in logistics. In Germany, the rapid diffusion of trucking began in the 1920s, with an average annual expansion rate of 22 per cent.[3]

There are several reasons for this expansion. First, there was technical progression in the construction and production of trucks, higher-bearing loads, more powerful engines, pneumatic tyres, and reduction in production costs. Truck transportation costs decreased by 60 per cent in the 1920s, owing to technical advances in the construction of trucks.[4]

Second, military and foreign political consideration contributed to this growth. The military contributed greatly to the initial distribution; already by 1908, the Prussian army administration had supported the acquisition of trucks by private companies. However, before 1914 the administration had not been able to decide in favour of a specific army motorization.[5]

The First World War was a decisive event for truck transportation, and for the first time trucks took over material supply at the front. After that war, in the countries of the warring parties, a large number of trucks were transferred from the army stock to the civil sector. Those provided an incentive for the development of new business models in the transportation industry, all the more so as laid-off soldiers knew how to drive the trucks.[6]

Another demonstration of the adaptability of truck transport was at the battle for the French occupation of the Ruhr. In 1923, when French troops occupied the Ruhr area and seized control of the railway system, the resulting gaps in freight traffic could be filled by the truck, and thus its usefulness could be clearly demonstrated.[7] Until 1930, Allied forces occupied the left flank of the Prussian province, the Rhineland, and cut the capacity of the railway. Thus, truck transport of cargo was substituted for railway transport and proved its advantages. By 1929, 30 per cent of the trucks in Prussia were located in the Rhineland.[8] To make use of the modern transport in cars, buses and trucks, Autobahn projects were planned to connect Aachen with Cologne, Düsseldorf with Cologne and Bonn with Cologne. The first Autobahn in Germany, Bonn–Cologne, was opened in 1932.

A third reason for the increase in road trucking in Germany was expansion of the infrastructure under pressure from the automobile lobby in the 1920s. Increased motorization put pressure on traffic policy to pursue innovative concepts, to build non-crossing highways in order to free traffic from the barriers and obstacles on normal rural routes and at cross-town links, and to reduce the risk of accidents. A developed road network also enabled the improved performance of truck transport. From this perspective, the rise in truck use seems to be a consequence of growing use of cars. Plans for the Hafraba motorway Hamburg–Basel as well as many initiatives for local highways, such as Mannheim–Heidelberg, Leipzig–Halle and the Rhineland's plans for the three motorway roads Aachen–Cologne, Cologne–Düsseldorf and Bonn–Cologne are examples of the Nazi motorway project in the 1930s.[9] In part, those plans were explicitly justified with the promotion of truck traffic and with innovative logistical concepts, as the planned motorway between Aachen and Cologne proves (cf. Figure 1). The request from the provincial committee to the 69th provincial Parliament of the Rhineland of 1925 regarding the construction of the Aachen–Düren–Cologne highway showed that current road conditions were unsustainable and that they threatened the existence of the industry. The request stated: 'The significant traffic of packaged goods in the Aachen–Düren area would profit from the highway. Especially the processing industries—as the textile, paper, needle and glass manufacturing industry—would benefit from it.'[10]

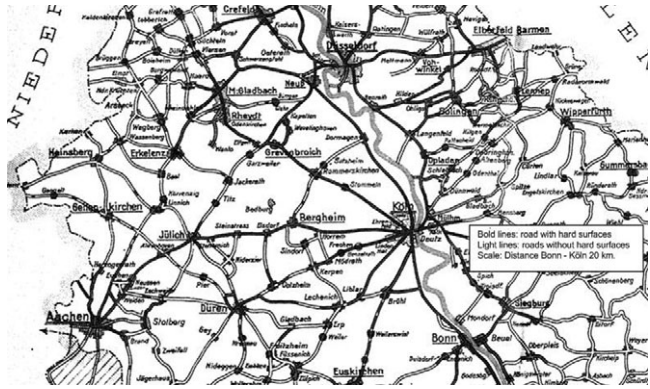

Figure 1 Map of the road network in the Rhineland 1926.
Source Verhandlungen des 70. Rheinischen Provinziallandtages (1926)

The role of road haulage in a mass consumption society

The diffusion of road haulage also needs to be considered with respect to the special demands made on transportation in the development of a mass consumption society, starting in 1880. A consequence of this is the thesis that a mass consumption society and truck transport are interdependent.

A mass consumption society interconnects the three elements of mass production, bulk sale and mass consumption. The basic approaches of the mass market developed when the railway and the postal services created large economic areas at the end of the nineteenth century.[11] The department stores that emerged at this time, mail-order businesses, and the chains of branch retail stores, which all developed since 1890, covered the whole German Reich, with a distribution network that offered consumer goods for a low price and in large quantities. This was the decisive factor for the mass market. With the mass consumption society a new kind of cargo arose: manufactured goods which could be delivered as packaged goods. These goods were packed in wooden boxes, baskets and cartons and shipped in small amounts. The broad offer of goods in branch-oriented retail sales required complex production and transportation functions.[12] This economic structure caused increased demand for many small, but urgent dispatches to supply stores with goods, including fresh food—as well as canned and processed—a demand which was best met by trucking and which exposed the limits of railway logistics. The handling points for goods traffic in the railway network were now overburdened and forwarding agencies with their own networks for local and long-distance truck traffic offered urgently needed alternative capacity for overloaded rail freight yards. They were able to handle transport faster and more cheaply than the railway.

After the trucks' breakthrough in the transportation system, new companies and innovative business models emerged, with road carriers, forwarding agencies, and in sales. One example is the forwarding agency Dachser, which was founded in Kempten in 1930 in order to supply the Ruhr area with Bavarian cheese, by truck.[13] In the 1920s, the creation of networks and the establishment of cooperative activities among transportation companies could be observed. Nevertheless, the state tried to regulate the goods traffic sector in favour of the railway.

The truck carriers were responsive to the new opportunities in the market offered by the truck.[14] Often they only operated a single truck which they bought in instalments from a truck manufacturer.[15] Since truck traffic had not yet been regulated by law, and liability insurance had not become obligatory, carriers were perceived as gamblers who operated 'wild traffic'.[16] New measures for designating minimum quality and security standards as well as for the stabilization of the truck-carrying trade were initiated by the chambers of industry and commerce and the associations of forwarders. Owing to the weakness of its members, the truck-carrying trade was unable to respond to economic fluctuations in the transportation demand and ruinous competition ensued.[17] Around 1930, the demand increased for state regulations throughout Europe as a result of the structure of the truck transportation sector.[18]

The limits of railways logistics for handling packaged goods

The deficiencies of railway logistics as service provider in a mass consumption society became evident in the 1920s, and provided an incentive for the development of truck-based logistical systems. Various contributions about the conflict between the railway and road traffic in the 1920s can be found in the literature, but they do not thoroughly review the functional problems of railway logistics.

Railway and truck transportation differed in various aspects, for example in their cost structures and ownership, as well as in the legal conditions of their operations. The economic models for railway and motorized transportation also differed to a large extent. The railway was based on a large, hierarchical organization with strict rules, whereas truck transportation was run by small entrepreneurs and was considered wild and anarchistic. Since roads were financed by the state, truck transportation merely had to pay for the wear of the roads but not their fixed costs. The wear costs were proportional to the length of the distance travelled and were paid together with the fuel tax as variable costs. Therefore, motorized transport had merely to bear the low fixed costs of the truck or the automobile. In addition, motorized transport was able to operate at any time without being dependent on a schedule. It was able to reach any destination by road even if those roads were in bad condition. The German railway, however, was a state-run business. It had to pay for the high fixed costs of the railway network, it operated on a fixed schedule, and it was limited to the track network.

The goods traffic on the *Reichsbahn* was sorted between packaged goods and wagon loads for bulk cargo, and for combined cargo of less than a wagon load. According to consignment notes, 87 per cent of the dispatches in May 1929 were packaged goods and 13 per cent were wagon loads.[19] Packaged goods are single unit loads that use the capacity of the wagon only partially, for example, a wooden box, cartons or a wooden barrel. While the wagon load used to be handled at cargo quays or was delivered directly to large factories, special freight yards were provided for the traffic of packaged goods. Those yards had goods sheds where the packaged goods were trans-shipped or stored separately, according to their destination and their receipt and outgoing.

The 1920s saw an increase in packaged goods in various areas, such as the food industry,where canned food was packed and sent in cartons. Another example was in the automobile production and the automobile trade—the important power nodes of a consumption-oriented economic system. Like many automobile components, tyres and rims for automobile wheels were not yet standardized, so if one of the 9,000 automobile repair shops or tyre garages in Germany needed a replacement or spare, it was most likely not in stock. Consequently, this triggered a demand in the spare parts system and initiated the dispatch of packaged goods. Parallel to the rapid distribution of automobiles in the 1920s, whose stock increased from 32,000 in 1920 to 501,000 in 1930 in Germany,[20] there was a considerable increase in packaged goods distribution. Another example for the increase of the exchange packaged goods is the advertisement of the large store chains in the 1920s. These advertisements were planned in a central marketing department and send to the branches in form of hot type frames.[21]

Were railway logistics able to adjust to the requirements of mass consumption? The importance of railway logistics can be proved by the fact that between 1900 and 1930, two-thirds of German railway (*Reichsbahn*) revenue resulted from the transportation of cargo.[22] The structure of goods traffic in railway logistics of the 1920s was such that in the entire German Reich, the *Reichsbahn* maintained 11,583 points of dispatch on standard gauge tracks.[23] Among these stopping points for the handling of freight were 9,362 railway stations in cities and villages. The other 2,221 points of dispatch were smaller stops in the countryside, which handled lesser volumes. The 11,583 points of dispatch constitute 134 million traffic relations from place A to place B (using the formula $N^*(N-1)$ with $N = 134$). According to logistics theory, this network is a 'many-to-many network' which enabled the gigantic spatial dimension of goods traffic. An analogue statement is valid for passenger transportation. One important characteristic of a many-to-many network is that, on average, the volume of goods transported between two places, A and B, in one week is low. When we consider the 20.4 million tons of packaged goods in 1929 and divide them by the 134 million relations, we get on average 150 kg freight per relation and year, or 3 kg freight per relation and week. These shipments did not fill a single 20-ton railroad wagon. Therefore, the structure of the shipments was

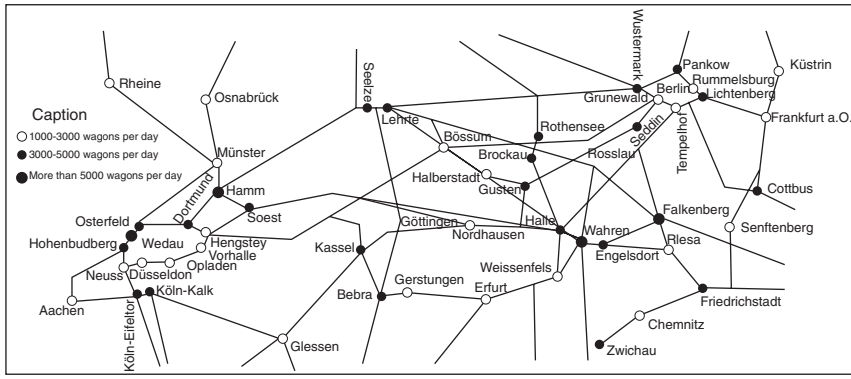

Figure 2 Marshalling yards in Germany 1922 where capacity ranged from 1,000 to 5,000 wagons per day.

particularly suitable to small trucks. The exchange of goods was only high between the 49 German cities with more than 100,000 inhabitants in the 1920s.

Initially, railways handled the transportation of most packaged goods. But the increasing shipments in the 1920s began to cause problems for railway logistics. As the manufactured goods industry grew, the *Reichbahn*'s traffic of packaged goods rose from 14.6 million tons in 1925 to 20.4 million tons in 1929, and railway logistics proved too slow to be able to comply with the requirements for speed.[24] The delivery of packed goods were urgent in many cases, particularly fresh food and spare parts. Furthermore, railway logistics was unable to offer sufficient terminal capacity and the terminals became congested (Figure 2). The *Reichsbahn* came under pressure from both sides. On the one hand, senders required faster traffic of packaged goods from the *Reichsbahn*, which at that time took at least four days between different cities. On the other hand, the truck—which guaranteed quick supply in the surroundings of large cities—put competitive pressure on the *Reichbahn*'s packaged goods traffic.[25]

The limits of railway logistics in the mass consumption society is explained in the following section under six considerations. The first two of them can be understood as strategic considerations: the price system and the marshalling yards as infrastructure. The remaining four considerations relate to the level of logistic processes and describe the slow and complex operations: the local network, the processes at the sheds, the trans-shipment halls and long distance trains.

Pricing

The price system (tariffs) for the transportation of goods by the railway was not geared to the costs of production but to the value of the goods themselves—the price system of a (regional) monopolist, which was geared

towards maximizing profit for the customers, and which was common all over the world. For high-value goods (e.g. manufactured goods), a high tariff had to be paid, for low-value goods a lower price. This price system, which did not give the corporate management an incentive to cut costs, was defined by the regulatory authority—as in countries with private railways.[26] Since the management of the railway was bound to this price system, it was unable to react to competition in the transportation market, where the truck offered an inexpensive alternative to the railway transport. Truck transport was cheap compared to the railway since it took into account only the actual transportation costs and not the value of the truck load.[27] This price model favoured truck transport, especially in the fast growing segment of manufactured goods in the mass consumption society.

Moreover, the price system of the *Reichsbahn* was very complex. Hundreds of different prices existed for various categories of goods and different relations between origin and destination. Long queues were common at the counters for handling the orders as clerks had to identify the right price in a time-consuming process.[28]

Marshalling yards as infrastructure

The rapidly developing demand for infrastructure services led to an increase in capacity, which had previously been achieved only in incremental steps. This thesis can be substantiated in relation to the motorway network and airports. This permanent expansion of capacity can also be observed with regard to marshalling and freight yards. As intersections of the goods traffic, they were liable to the risk of overcharging.[29,30]

However, the incremental expansion of yards is harder to handle than with motorway networks or airports. Instead of building large formation yards at the places with the largest traffic volume, capacity was increased by creating additional, small formation yards. This incremental expansion of capacity in the formation yards has been criticized in the literature since it has impeded rational transportation planning. One explanation is that the formation yards built in the nineteenth century were considered technologically outdated, but could not be modernized entirely. Before 1920, the German states railway had not coordinated the network of the formation yards overall, but created independent capacities.[31] Although the infrastructure did not fully meet the requirements for goods traffic, it nonetheless handled the transportation as far as the capability of the respective switch-yards allowed.[32]

Using the example of Cologne's railway network, this paper shows how five freight yards (Cologne–Kalk, Cologne–Gereon, Cologne–Eifeltor, Cologne–North, Cologne–Mühlheim) were expanded and rebuilt constantly between 1890 and 1930, but were never able to overcome the shortage effectively.[33] A similar race for increased capacity occurred during the construction of the motorway in the 1960s and 1970s, as traffic volume exceeded available capacity, and the railway reached its limits in serving the cities. Owing to the concentration effect, the Cologne North yard, which

accumulated 10,000 freight wagons daily for destinations east of the Rhine River, had to be closed to incoming traffic at various times, until the accumulated freight wagons had left.[34] The overloading and congestion of the freight yards offered a strong incentive for the forwarder to substitute railway transport with direct truck transport between forwarder and receiver. Consequently, decentralization of truck traffic also led to decentralized handling in decentralized freight terminals.

Movement in the local network

Whereas small cities had only one railway freight yard, the situation was completely different in big cities, which might have several terminal stations in the city centre. Moreover, there were a large number of freight yards in the suburbs which, as a local freight network, made the surrounding area accessible. This network was complemented by specialized terminals: the post station, the central market station, and the abattoir station (Figure 3).

The network of freight yards in the city of Breslau (now Wroclaw in Poland) (Figure 4) consisted in 1929 of 24 freight yards, which had sheds

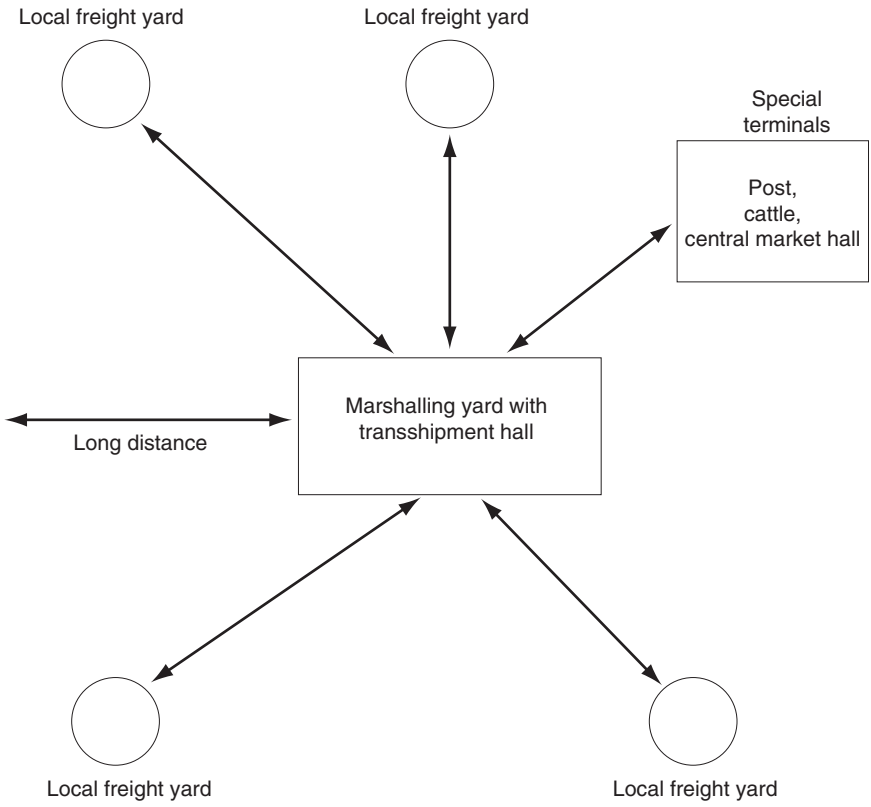

Figure 3 Model of a local freight network of a big city.

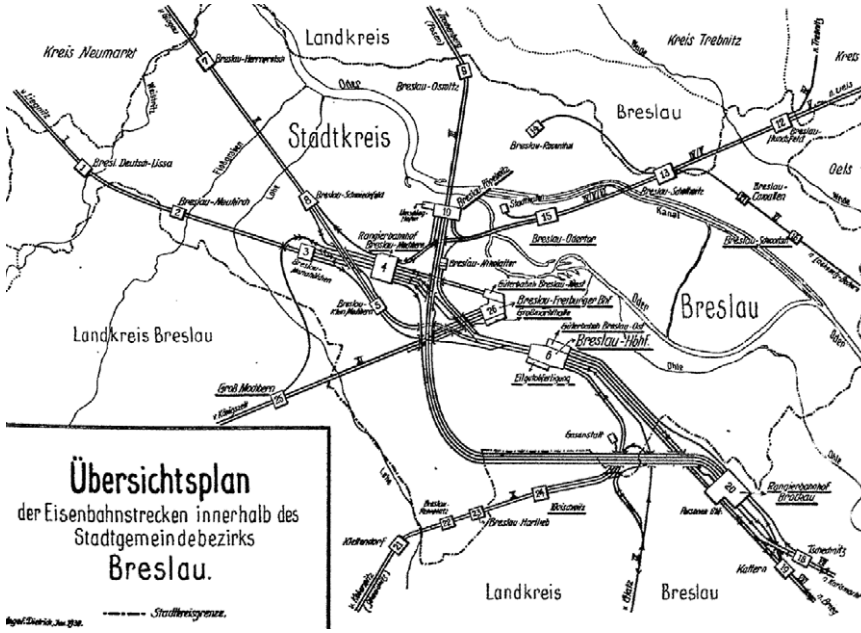

Figure 4 Rail network, Breslau yards.

for the trans-shipment of packaged goods.[35] A central switchyard controlled the movement of the specifically organized local goods trains in the network, which comprised wagons both for bulk cargo and for packaged goods. This interconnection of the two transportation types made transportation in the network particularly difficult and slow.

From a city logistical point of view, in metropolitan cities like London, Paris or Berlin, the traffic between the city terminal stations was very complex, because these stations, which were only a few kilometres apart, could only be connected via the orbital railway on the periphery. Accordingly, fairly early on (at the beginning of the 1920s), the exchange of packaged goods between terminal stations in Berlin was taken over by direct truck traffic. Thus, 222 fixed routes emerged on which trucks connected the terminal stations and the yards at the orbital railway and the city railway. On average, 200 tons of express freight were trucked every day. Transportation was organized by the national haulage company Marken.[36] The economic advantage of those transports was apparent. The *Reichsbahn* saved 150 wagons which would otherwise be used for transportation. Road truck traffic also handled the transport in half the time. Whereas packaged goods on long-distance routes were previously transported via Berlin on railway wagons, after 1922 goods were often offloaded at Berlin onto trucks. Express goods from Munich to Stettin (now Szczecin in Poland) were loaded onto a truck at the Anhalter Bahnhof railway station and were then transported

across Berlin to the Stettiner Bahnhof railway station, where they were then loaded onto the train bound for Stettin.

The processes in the sheds

The organization of delivery services for packaged goods from a railway station was extremely complex. If the receiver did not personally collect the packaged goods (self-collector), or if they did not commission (private) forwarders, the railway agent assumed this task. The handling of incoming packaged goods at large railway stations required considerable organization and led to freight yard congestion and long waiting periods. Self-collectors and the assigned forwarders had to be informed about the arrival of the goods. Moreover, the forwarders had to show certificates of authority. Finally, storage space in the goods shed had to be allocated according to three categories: self-collectors, forwarders and rail forwarders. This complexity required 30 per cent more storage space. In the city of Leipzig the organizing of goods traffic at the Dresdner Bahnhof involved 75 forwarders with 6,500 certificates of authority and 1,200 self-collectors.[37] The incoming packaged goods for delivery had to be checked thoroughly. With such fragmentation in the delivery services in the city area, where the same streets and the same destinations were visited at various times by different forwarders, the concept of integrating traffic movement made sense. But this was not reviewed again until the city logistical planning of the 1990s.

In Germany the choice of delivery type was primarily determined according to §78 of the Railway Traffic Regulations. However, the regulation could be limited or totally bypassed by the railway in consultation with the state regulatory authority.[38] In order to decrease the surcharge on the freight yards, the railway stations Elberfeld and Barmen launched a model test for methods to simplify delivery. Self-collection and (private) forwarders were no longer allowed and only railway agents were authorized to deliver goods, resulting in a simplification of the handling.[39]

The handling of packaged goods at the goods sheds of the local freight yards required a time-consuming switch of wagons, which had to be positioned precisely at the hatch of the shed for loading and unloading. A shortage in goods traffic capacity emerged when the traffic of packaged goods by the *Reichsbahn* increased. As early as 1911, all goods terminals in Berlin reported a heavy overload during the autumn peak period.[40]

The goods shed, whose cargo quay was 200 m long, functioned as an interface between two infrastructures, railway and road, and revealed the limits of railway logistics. While horse-drawn vehicles or motorized trucks were able to turn round or switch arbitrarily on the cargo quay, the wagons were confined to the linear dimension of the track. Moreover, horse-drawn vehicles or trucks could switch independently whereas goods wagons had to approach the shed as one train.

The cost structure of the packaged goods service on the *Reichsbahn* (Table 1) reflects the time and effort involved in the trans-shipment operations.

Table 1 Cost structure of packaged goods service in 1929

Process	*Cost in million RM*	*Share (%)*
Shed	238	40.3
Trans-shipment hall	106	18.0
Marshalling	103	17.5
Train transport	143	24.2
Total	**590**	**100**

Source Deutsche Reichsbahn (ed.), *Das Wirtschaftsergebnis des Fernverkehrs im Jahre 1929* (Karlsruhe, 1929), p. 45, Federal Archive, file R5/12206.

Fifty-eight per cent of the total cost was incurred in the sheds and trans-shipment halls and only 24 per cent in transport itself.

Various statements show that the railway's traffic of packaged goods was not cost effective: a large proportion of dispatches comprised only of small quanities, travelling short or medium distances and their low transport price did not cover the administrative effort involved in the preparation of letters of consignment and the numerous handling procedures in the goods shed.[41] In 1923, the *Reichsbahn* founded an academic commission to investigate the use of trucks in local traffic.[42] By then, a pilot project had been started in Berlin to transfer packaged goods traffic, of an average 40 tons per day, by road between Görlitzer Bahnhof railway station and Königswusterhausen.[43] Surprisingly, however, the *Reichsbahn* did not pursue a general policy to give up the uneconomic packaged goods traffic locally and transfer it onto the truck—either to an own truck-subsidiary or to a foreign company—as the railways in the UK and France had done.[44] The *Reichsbahn* missed the opportunity to identify a strategic goal for its enterprise by including trucks in the transportation goods, concentrating its mission solely on running trains.

The *Reichsbahn* searched for ways to accelerate transportation and increase the performance of the sheds. Thus, the board of the *Reichsbahn* in Cologne separated wagon load traffic from the traffic of packaged goods in the Cologne network, and thereby accelerated handling. This model was copied by other *Reichsbahn* authorities.[45] The authority even attempted to extend capacity with the help of two floor sheds or, as in Cologne–Gereon, by placing the wagons upright at the shed.[46]

Difficult processes in the trans-shipment halls

A trans-shipment hall was always located in the network's central switch-yard, with six to eight platforms for packaged goods. This hall functioned as a hub with two functions.[47] First, wagons with packaged goods received from local yards were trans-shipped here; second, the packaged goods that came in from the long-distance traffic were trans-shipped in this hall and distributed to the local yards. At the same time, the hall was the place where the outbound shipments were handled. The handling halls were of

considerable dimensions. For example, the hall in Cologne–Kalk North was 400 m in length; and 400 wagons were unloaded there every day in 1925.

The necessary trans-shipping work of packaged goods at the hub were extremely labour- and time-consuming. Trans-shipment problems could arise because of erroneous destination marking, and misallocation of wagons. Damage could occur during the switching operation if wagons collided.[48] Moreover, a schedule had to be calculated which showed when sufficient packaged goods had been accumulated, ready for shipment. A wagon of packaged goods could not be loaded until at least three tons of packaged goods destined for a particular place ('wagon of place') or a transfer station ('transfer wagon') was in stock.[49] Accordingly, the transportation delay between two infrequented handling points was in the range of weeks. As the platforms in the trans-shipment hall had the layout of a comb and the hall was 400 m long, the trans-shipment of cargo between wagons at different platforms had to cover a great distance on the average. Trans-shipment halls could be vast (Figure 5).

In Germany, the *Reichsbahn* in 1933 had a network of 65 trans-shipment halls for packaged goods, that was itself a many-to-many network with 65 × 64 = 4,160 traffic relations. But not all these relations were served by regular direct trains. Of those 4,160 traffic relations, only 1,583 were carried out on direct service and many packaged goods had to be handled twice in a trans-shipment hall before they could reach their target railway destination. The five locations with the greatest traffic in packaged good trains in 1933 are shown in Table 2, highlighting the degree of traffic in the harbour cities of Hamburg and Bremen.[50]

Figure 5 The huge packed goods trans-shipment hall in Stettin (now Szczecin in Poland) 1934.
Source Permission of Eisenbahnstiftung Joachim Schmidt

Table 2 Locations with the greatest traffic of packaged goods trains

Location	*Number of trains*
Hamburg	62
Nürnberg	53
Köln Kalk Nord	48
Bremen	48
Bietigheim	48

Long-distance trains

Similar problems to packaged goods traffic are found with long-distance freight trains which, unlike express trains, did not make intermediate stops.[51] At the formation yards, fully loaded wagons were grouped according to destination. Destinations of more than 100 km were served by long-distance trains consisting of wagons for the specific destination, which travelled directly without any intermediate stops. At first glance, this organization of goods traffic promised rapid transportation of goods to distant destinations. However, this could not be achieved practically since it took days to accumulate sufficient long-distance wagons for the same destination. The further away the destination, the longer the wait. If the waiting time became too long, the accumulation of wagons was terminated, and a cargo train transported the relevent accumulated wagons together with other wagons to a formation yard closer to the eventual destination. There, the train was dismantled with expensive switching operations and was attached to a new train for the rest of the journey. Partial transport on medium distances substituted for the actual long-distance transport.[52] In this case, the theoretically anticipated rationalization advantage of long-distance transports vanished. Moreover, the duration of wagonload traffic was much increased. Also, with the long-distance transport of packaged goods, multiple reloading operations were necessary.

Conclusion

This paper shows the limited suitability of railway transport in a 'many-to-many network' which, owing to its multitude of small shipments, can be served more flexibly and quickly by road trucking. The railway enterprise did not recognize the special requirements of the many-to-many network and continued to operate along the traditional rules of the nineteenth century. With the exploding rise in the exchange of packaged goods in the twentieth century the nodes of the railway logistics became more and more congested. The concentration of traffic towards the 65 trans-shipment halls was a strategy that could not cope with the demands of customers who expected fast services. Instead of concentration the road trucking firms developed decentralized solutions. According to the locations of demand,

they established small trans-shipment yards in the city suburbs offering faster services for their customers.

This article has explored the role of truck traffic in a mass consumption society. The various fields of railway logistics have been discussed, as well as the role of packaged goods traffic in a consumption-oriented economic system. The limitations of the railway in handling the transfer of packaged goods, long-distance traffic and the capacity problems of switchyards gave truck forwarders new opportunities to transfer handling to their own terminals.

Notes

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14 P. Van Elsen, *Die deutsche Landstraße, verkehrsgeographische Betrachtungen über ihre Entwicklung vom Postzeitalter bis zur Gegenwart* (Düren, 1929); L. Heder, *Die Konkurrenzfähigkeit der Kraftwagen und Kraftwagenlinien gegen Eisenbahn und Kleinbahn* (Berlin, 1931).
15 K. Mellerowicz, 'Autobahnen und Kraftverkehrswirtschaft', *Die Autobahn*, 9 (1934), 370. According to an investigation by the Chamber of Industry and Commerce of Berlin, the average number of trucks per haulage company in the area of Greater Berlin in 1932 amounted to 1.46 trucks.
16 Deutscher Industrie- und Handelstag, *Eisenbahn und Kraftwagen*, 41. The Chamber of Commerce journal in Cologne reported on 'wild' competition under the truckers, *Westdeutsche Wirtschaftszeitung* (5 July 1929), p. 408; 11 January 1929, p. 34, Rheinisch-Westfälisches Wirtschaftsarchiv Cologne.

17 *Speditions- und Schiffahrtszeitung* (1928), p. 346 fo.
18 B. Bayliss, *European Transport* (London, 1965), p. 66. In Great Britain, truck traffic was regulated in the year 1933, see Paul Wohl and A. Albitreccia, *Road and Rail in Forty Countries* (London, 1935).
19 U. Steuernagel 'Zur Struktur des Reichsbahn-Güterverkehrs: Frachtbriefzahl und Frachtaufkommen', *Die Reichsbahn*, 6 (16) (1930), 416. In 1929 the *Reichsbahn* transported 21 million tons of packaged and express goods, and 411 million tons of wagon loads. *Statistisches Jahrbuch für das Deutsche Reich*, 1933, p. 163.
20 Flik, 2001, p. 281. In the absence of standardization of rims and tyres see *Die Gummibereifung* 4 (1928).
21 Fritz Wertheim, *Die Reklame der Warenhäuser* (Köln, 1931), 46.
22 *Statistisches Jahrbuch für das Deutsche Reich*, 1903, p. 67; 1928, p. 149 fo.
23 *Statistik der im Betriebe befindlichen Eisenbahnen Deutschlands* (Berlin, 1929), p. 111.
24 *Statistisches Jahrbuch für das Deutsche Reich* (Berlin,1929), p. 152; and 1933, p. 163.
25 Meyer, 'Zweigeschossige Güterschuppen', *Die Reichsbahn*, 5 (17) (1929), 222–8; U. Steuernagel 'Zur Struktur des Reichsbahn-Güterverkehrs: Frachtbriefzahl und Frachtaufkommen', *Die Reichsbahn*, 6 (16) (1930), 416. The thesis of the railway's insufficient terminal capacities contradicts the estimations of Alfred Mierzejewski, *The Most Valuable Asset of the Reich: a History of the German National Railway Vol. 1, 192–1932* (Chapel Hill, 1999), p. 145, who postulates a low utilization of marshalling yards based on the publications of railway scientists.
26 For the USA, see Albert J. Churella, 'Delivery to the Customer's Door: Efficiency, Regulatory Policy, and Integrated Rail-Truck Operations, 1900–1938', *Enterprise and Society*, 1 (2009), 98–136, here p. 105.
27 Scott, 2002. Many authors argue that the truck forwarder calculate only marginal costs as transportation costs. But this point of view is incorrect. Marginal costs are the increase of the total costs, when the truck loads an additional entity or if it drives a kilometre further. But the total costs of a truck consist of the variable costs (use of gas, tyres, salary of the driver, service, loss in value due to kilometres navigated), and of the fixed costs (insurance, tax, loss in value due to deterioration).
28 H. Kayser, 'Die wirtschaftlichen Ergebnisse der Rationalisierung bei der Güterabfertigung Magdeburg Hbf', *Die Reichsbahn*, 6 (1930), 1046–53, here p. 1048.
29 From 1908 to 1915, the number of goods wagons in the German Reich rose rapidly from 500,000 to 700,000, see Sommerlatte, 'Der Güterwagendienst', *Das Deutsche Eisenbahnwesen der Gegenwart*, vol. 2 (1923), 147–60, here p. 151.
30 Baumann, 'Die Bedeutung der Verschiebebahnhöfe für das deutsche Verkehrs- und Wirtschaftsleben', in: *Verkehrstechnische Woche*, special issue Rangiertechnik, Berlin (December 1922), 7–11.
31 W. Cauer, 'Lage und Verkehrsaufgaben der Verschiebebahnhöfe', *Verkehrstechnische Woche*, special issue Rangiertechnik (1922), 3–7.
32 *Ibid.*, p. 3.
33 Regarding the history of the expansion of the freight yards at Cologne, Heilbronn and Berlin-Tempelhof, see Busse, 'Der Umbau des Verschiebebahnhofs Tempelhofs', *Verkehrstechnische Woche*, 19 (1925), 585–9; A. Reifferscheidt, *Der Nahverkehr im Kölner Wirtschaftsbezirk* (Cologne, 1926); Köhle, 'Rationalisierung des Verschiebebahnhofs Heilbronn', *Verkehrstechnische Woche*, 23 (1929), 613–15; H. Pohl, *Die Reichsbahn im Raum Köln* (Cologne, 1933).
34 Löhr, 'Grundzüge der Güterbeförderung durch die Eisenbahn', in Ernst Esch (ed.), *Die Spedition* (Cologne, 1922), S. 201–32, here p. 220.
35 Brühl-Schreiner, 'Einrichtung eines Ringgüterzugverkehrs zwischen Breslauer Bahnhöfen', *Die Reichsbahn*, 6 (1930), 473–80, here p. 473.
36 W. Teubner, 'Eisenbahn und Kraftwagen', *Verkehrstechnische Woche* (1924), 1–5, p. 2 fo.
37 Poelmann, 'Vorzüge und Nachteile der Bahnspedition sowie Wege zu ihrer Verbilligung' *Der Güterumschlag* (1926), 52–6, here p. 52. He points out that in the UK the goods were rolled on and off by carters charged by the railway only.
38 Heider, O., 'Die Bahnspedition', in Ernst Esch (ed.), *Die Spedition* (Cologne, 1922), 149–69, here p. 156.
39 Poelmann, p. 53.
40 Archive of the state Berlin. A Rep. 080, file 13477 (old) or 614 (new).
41 Jacobi, 'Ein Beitrag zur Frage der Wirtschaftlichkeit des Stückgutumladung', *Verkehrstechnische Woche* (1924), 137–9; Eggert, 'Leichte Güterzüge', *Die Reichsbahn*, 5,

no. 17 (1929), 398–400. Schmitt, 'Rationalisierung des Stückgüterdienstes', *Zeitung des Vereins deutscher Eisenbahnverwaltungen* (1929), 835–41. Steuernagel 1930 found out that in May 1929, 49 per cent of packaged goods shipments were billed in the tariff up to 1.50 RM. For more, see *Deutsche Speditions- und Schiffahrtszeitung*.

42 W. Teubner, 'Eisenbahn und Kraftwagen', *Verkehrstechnische Woche* (1924), 1–5, here p. 5.

43 *Ibid*. An extension to Cottbus was planned.

44 Simon-Thomas, 'Die Behandlung von Stückgütern in den Verschiebebahnhöfen', *Verkehrstechnische Woche* (1933), 44–9, suggested the local dispatch of packaged goods via truck. Patrick Fridenson, 'Some economic and social effects of motor vehicles in France since 1890', in: Theo Barker (ed.), *The Economic and Social Effects of the Spread of Motor Vehicles* (London, 1987), pp. 130–47, here p. 139; Scott, 2002, p. 115.

45 'Die deutsche Reichsbahn im Jahre 1929', *Die Reichsbahn* 6 (1930), 9–19; Eggert, 'Leichte Güterzüge', *Die Reichsbahn*, 5, no. 17 (1929), 398–400; Reffler, 'Die neue Stückgutumladehalle in Chicago', *Zeitung des Vereins Deutscher Eisenbahnverwaltungen* (1928), 893–6.

46 Meyer, 'Zweigeschossige Güterschuppen', *Die Reichsbahn*, 5 (17) (1929), 222–8.

47 Simon-Thomas, 1933.

48 Löhr, 'Grundzüge der Güterbeförderung durch die Eisenbahn', in: Ernst Esch (ed.), *Die Spedition* (Cologne, 1922), 201–2, here p. 217, p. 221. Wagons with fragile load were specifically labelled at handling. See O. Ammann, 'Verständigungsmittel auf Rangierbahnhöfen', *Verkehrstechnische Woche*, 22 (1928), 151–60, here p. 156. Regarding the organizational effort of packaged goods traffic, see A. Reuver, 'Stückgut- oder Wagenladungsverkehr', *Speditions- und Schiffahrtszeitung*, 38 (1930), p. 95; Leskow, R., 'Die Wirkung der Stückgut-Tarifreform auf den Fachhandel', *Speditions- und Schiffahrtszeitung*, 38 (1930), 538fo. and *Speditions- und Schiffahrtszeitung*, 39 (1931), p. 6.

49 Löhr, 1922, p. 216.

50 Reuver, 1930, p. 95; P. Gerhardt, 'Die Güterbeförderung der Deutschen Reichsbahn', *Westermann Monatshefte*, 160–II (959) (1936), 445–52, here p. 449. Federal Archive, file R5/20596. It remains unclear whether the trains operated daily or in longer periods.

51 Löhr, 1922, p. 222.

52 Cauer, 1922, p. 4 speaks about a second to third switch of trains in national long-distance traffic. In international transit traffic, goods wagons were sometimes reassembled four or five times. According to a sample in July 1921, transports of goods wagons were reassembled on average 2.3 times, see Kümmell, 'Über Größe und Lage der Verschiebebanhöfe', *Verkehrstechnische Woche*,special issue Rangiertechnik (1922), 13–15, here p. 14.

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