Railway and Truck Transport in Europe in 20th Century

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Content

1 Introductory remarks

The development of the mass consumer society in the 20th century enabled the systems of goods distribution in the retail trade and the supply of goods for the upstream consumer goods industries, which are described by the term logistics.[1] This term comes from the military supply system and only became established in Germany in the 1960s - coming from the USA - in the civilian sectors of goods distribution for trading groups and for procurement activities of industrial companies.[2] At the beginning of the 1970s, Gosta Ihde, Professor of Business Administration at the University of Mannheim, and Wolfgang Lück, Professor of Business Administration at the Research Centre for Brewing Economics in Berlin, played a leading role in anchoring the concept of logistics in business administration.[3] The standard encyclopaedias of the turn of the century 1900 do not know the concept of logistics, at most as an art of calculation. This term also does not exist in the railway encyclopaedias.

Logistics can first of all be subdivided traditionally into the areas of transport, handling and storage. One also speaks of TUL logistics - a term that has appeared since the 1960s in German-speaking countries and was also used in the GDR (1949-1990). Modern logistics, which goes beyond TUL logistics, only began in the 1980s with computer networks. I will pick out two examples of warehouse management: the warehouse of Rhenania Spedition on the Rhine and the Speicherstadt in Hamburg.

2 bulk goods and the railway

In Europe, bulk goods were transported on rivers, canals and railway lines. Warehouses for storage and transhipment settled on these lines. By the end of the 19th century, the Rhine had developed into a "factory road for mass raw materials", as economic geographer Bruno Kuske put it. The 440 km long stretch between Wesel and Karlsruhe was navigable at the end of the 19th century with a water depth of 2 m and regulated to Basel.[4] Basel was thus given the status of the "Port of Switzerland", linking Switzerland with Rotterdam. The[5] chemical industry was lined up between Basel and Cologne like a string of pearls along this river and, among others, had Ludwigshafen and Frankfurt a.M., important locations on or near the Rhine. The inland port of Duisburg supplied the chemical industry

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[1] On the mass consumer society see the excellent study by Wolfgang König: Geschichte der Konsumgesellschaft, Stuttgart 2000. Furthermore: Reckendrees, Alfred (Hersg.): Die bundesdeutsche Massenkonsumgesellschaft 1950 - 2000, Berlin, 2007.

[2] John Magee: The Logistics of Distribution, In: Harvard Business Review 38 (1960) 4, S. 89-95.

[3] Wolfgang Lück: Logistik in der amerikanischen Managementlehre, in: der selbenelbe (Ed.): Logistik und Materialwirtschaft, Berlin 1984. Gösta Ihde: Logistik, Stuttgart 1972. Herbert Kotzab: Logistik. Quo vadis? in Günter Prockl (Ed.): Milestones in Modern Logistics, Wiesbaden 2004, p. 123.

[4] Bruno Kuske: The national economy of the Rhineland in its peculiarity and significance, Essen 1925, p. 36.

[5] Hans Bauer: Basel, yesterday-today-morrow: One hundred years of Basel economic history, Basel 1981.

with coal, among others from the forwarding company Haniel, which can look back on a company history of more than 250 years.[6] In the 1960s, oil refineries settled on the Rhine in Karlsruhe, Mannheim and Cologne, which also supplied Frankfurt Airport with kerosene by tanker.[7] The rafting industry supplied Holland with tree trunks from the Black Forest. The rafters left behind many orphans with their life-threatening profession; the city of Pforzheim established an orphanage and workhouse, whose occupants founded the watch and jewellery industry in Pforzheim.[8] On the Rhine there were warehouses of the mill industry, among others the warehouse of the Rhenania forwarding agency in Mannheim built in 1910 (see Figure 1). This was equipped with mechanical elevators, which transported the grain from the ships to the top floor of the warehouse, from where it could flow by gravity through pipes into the chambers provided. The elevator warehouse technology was an innovation from Chicago, where the Midwest grain harvests were concentrated from the 1850s onwards.[9]

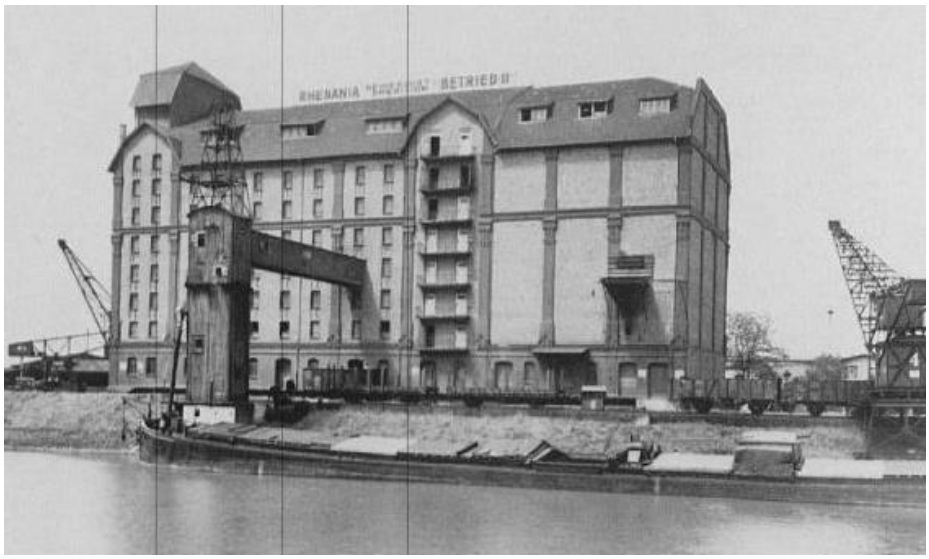

Figure 1: The Rhenania elevator warehouse in 1921[10]

The warehouses of the milling industry had the functions of grain storage, grain to flour processing and filling. The grain was filled into railway wagons, trucks and jute bags weighing 100 kg. For these

[6] There are numerous studies and commemorative publications on the shipping companies on the Rhine: Hermann Hecht: The Rhenania Group - the First 30 Years, Cologne 1983 Andreas Kunz: The economic performance of inland navigation in Germany, 1835-1935: a reassessment of traffic flows, in: Andreas Kunz and John Armstrong (Ed.): Inland Navigation and Economic Development in Nineteenth Century Europe, Mainz 1995, p. 47-78 Herbert Lehmann: Duisburg's wholesale and forwarding companies from the end of the 18th century to 1905, Duisburg 1958. Martin Veiden: 200 years of Haniel, Duisburg 1956. Hermann Hecht: The formation of the Rhenania Group - the first 30 years, Mannheim 1983.

[7] Rainer Karlsch and Raymond Stokes: Factor Oil - The Mineral Oil Industry in Germany 1959 - 1974, Munich 2003.

[8] Badisches Städtebuch; Volume IV 2, edited by Erich Keyser, Stuttgart, 1959.

[9] William Cronon: Nature's Metropolis - Chicago and the Great West, New York 1991, p. 111. Cronon also describes deforestation in the north of Chicago with photos of clear cut areas, which could be interesting for environmental historians.

[10] Source: Hermann Hecht: The formation of the Rhenania Group - the first 30 years, Mannheim 1983.

sacks there was a nationwide lending and rental system.[11] When the chain stores of the retail trade emerged in the 1920s, the delivery of flour in 100 kg bags was no longer up to date, as the mostly female employees of the chains could not cope with these bags. This is a gender aspect in the history of logistics that has not yet been taken into account. As nodes in the supply chain, the milling industry in Germany apparently had a monopoly position, as it did not respond to requests for improvement from the trade, but continued to deliver the goods in 100 kg sacks instead of the desired smaller sizes. The[12] extraction and processing of large quantities of grain led to a strong development of dust, which had to be collected separately and led to accounting problems due to weight reduction.[13]

An example of an early, sophisticated storage technology can be found in the Speicherstadt Hamburg. The Speicherstadt was built on a free port site after Hamburg joined the customs territory of the German Reich. The warehouses previously located in the urban area were concentrated in the free port. In order to be able to deliver duty-free to the German Reich, however, Hamburg's industry had already settled outside the customs territory of Hamburg, e.g. in Altona, before Hamburg joined the customs territory of the German Reich. The industry thus surrounds the old Hamburg in a ring. The Speicherstadt Hamburg had built up the coffee, tea, tobacco and chocolate industries in the Hamburg area, which were important for the mass consumer society, in a joint project as a closed ensemble in the 1880s, after the Old Town quarters had been rigorously demolished there. In the warehouses, coffee and cocoa beans were stored in jute bags on behalf of the Hamburg coffee and chocolate industries, as well as tobacco and tea, see Figure 2.[14] The chocolate industry was more important than commonly assumed. An analysis of the suppliers to the food trade in 1926 revealed 161 plants in Germany for the chocolate industry and thus the top of the food industry, followed by the vinegar plants with only 112 plants. For the[15] important rubber industry in the Hamburg area, which produced hoses for machines and tires for bicycles and later also for automobiles, the Speicherstadt was also used to store bales of rubber.[16]

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[11] Klaus Grass: Die Binnenschiffahrtspedition - Die Organisation und Betriebstechnik im Speditionsgroßbetrieb der Rheinschiffahrt, Dissertation University of Frankfurt 1927, p. 99.
[12] Richard Vahrenkamp: The Logistics Revolution - The Rise of Logistics in the Mass Consumption Society, Frankfurt 2011, p. 42.
[13] Förster (no first names): Der Berliner Westhafen, in: Der Güterumschlag, conference and exhibition of the VDI in Düsseldorf and Cologne 1925, special edition of the magazine of the VDI, Berlin 1926, p.141-148.
[14] Dierk Lawrenz: The Hamburg Speicherstadt, Freiburg 2008. Frank M. Hinz: Planning and financing of the Speicherstadt in Hamburg, Münster 2000.
[15] Data after German calendar for the colonial goods and delicatessen trade 1927, Berlin 1926.
[16] Dietrich Kausche: From the early days of the Harburg rubber industry: The beginnings of the Cohen brothers' rubber factory in Wilstorfer Strasse (1856-1864). Hamburg 1981.

Figure 2: Transhipment in the Speicherstadt: Loading of a tobacco barrel in 1947 (Approved by the photo archive of the Port of Hamburg)

While since the 1980s logistics has been talking about outsourcing warehouse operations from industrial companies, the[17] warehouse business in the Speicherstadt was realised from the outset as a separate activity. In the warehouse business, the beginnings of descriptive statistics developed. There, records were kept of the stacking areas and the quality of the goods; samples were taken with tubes that were used to prick the jute sacks and stored in bags. In the German-language textbooks on statistics, therefore, one still speaks today of a "sample" that is "drawn" (from sacks). In the English statistics it is simply called sample.

The railway was the most important mode of transport for the transport of bulk goods from agriculture and basic industries. The construction of railways was strongly politicized in the 19th and up to the middle of the 20th century. The German small states determined the lines suitable for them. The line from Wesel to Antwerp, known as the "Iron Rhine", reduced the Ruhr area's dependence on Dutch ports and brought the newly founded state of Belgium Traffic to its port city of Antwerp. Unlike France, Germany was politically and economically decentralised. This structure led to a dense railway network in Germany, while in France the lines ran star-shaped to Paris.[18] Germany and Austria dominated Central Europe in terms of railway policy with the Association of German Railway Administrations. The annexation of Alsace-Lorraine after the Franco-German war of 1870/71 strengthened German railroad political supremacy and cut Basel off from the Franco-Eastern railway network. In order to create a new connection to the eastern French railway network, the rail link from Belford via Belle to Bern through the Jura was built, over which the goods traffic with the port of Antwerp ran.[19] With the exceptional seaport tariffs of the German railways, the Swiss export of

[17] Richard Vahrenkamp and Herbert Kotzab: Logistics - Management and Strategies, 7th edition, Munich, 2012, Chapter 24.
[18] Fernand Braudel: France, vol. 3, Things and People, Stuttgart 1990, p. 289.
[19] Bauer, Basel 1981, p. 22.

goods could also be carried out cost-effectively from Basel via the North German export ports.[20] Switzerland's exports could also have taken place via the nearby ports of Bordeaux and Nantes as French export ports. But there were no cross connections from Bordeaux or Nantes to Bern. In order to reduce the influence of the Germans in Central Europe and also to connect Western Switzerland to the West French export ports, cross connections along the 45th parallel from Bordeaux via Northern Italy to Bucharest have been repeatedly discussed in France since 1900 and have been referred to as the 45th degree line.[21]

3 General cargo as a new category of goods in the 20th century

General cargo refers to goods that are packed in cartons, barrels, sacks, baskets or wooden crates but which, as individual pieces, do not make full use of a railway wagon. Usually a piece goods weighs between 1 kg and 100 kg. Logistics in the 20th century can also be interpreted as a strong expansion of general cargo transport, which served to supply retail chains and culminated in the small-scale parcel dispatch of Internet trade, see Figure 3.

Figure 3: Parcels at Amazon's Bad Hersfeld distribution centre (press photo Amazon 2012).

[20] For exceptional seaport tariffs, see Kurt Wiedenfeld: Die Raumbeziehungen im Wirtschaften der Welt, Berlin 1939, p. 184. According to Wiedenfeld, these exceptional tariffs were common in many countries.

[21] Irene Anastasiadou: In Search of a Railway Europe – Transnational Railway Developments in Interwar Europe, Amsterdam 2009, S. 42.

Railway historians have so far ignored the categories of general cargo. The main categories of goods in railway statistics concerned only bulk goods, while general cargo was hidden in the category "Other".[22] The increase in general cargo led to an enormous consumption of sawn timber for the production of wooden crates and barrels. Estimates for the USA in 1930 assume consumption of 14 % of sawn timber production for wooden crates and barrels alone.[23] In its barrel factory opened in Hamburg in 1896, the German-American Petroleum Society produced 600,000 wooden barrels a year for which it imported 12 million oak sticks from the USA with 10 loads of sailing ships each year. In[24] Baku, Russia's oil-producing region, the lack of wood in the 19th century forced the company to abandon the production of wooden barrels and to ship the petroleum produced in steel barrels.[25]

The reasons for the expansion of general cargo were numerous. One should mention the mail order business for consumer goods, which was established at the end of the 19th century and which received strong impetus from the simplification of postal traffic since 1870. It enabled orders to be placed by customers in small towns and flat areas using the newly created medium of the postcard and was based on a postal delivery network for the delivery of parcels.[26] Factories for consumer goods, such as textiles, household articles and furniture, but also large department stores advertised in newspaper ads for the mailing of their articles, as well as suppliers of butter and honey. With the expansion of the mail order business, catalogues became an advertising medium. The increasing industrial production of finished food products, which were packaged in cartons and shipped from the factories to the trade as general cargo, also boosted the general cargo sector. One example is the famous bag soups and meat extracts from the Swiss entrepreneur Julius Maggi.[27] Another reason for the increase in unit sales was the shipment of spare parts. An entrepreneur in the rapidly expanding mechanical engineering industries in the broader sense, which had emerged at the beginning of the 20th century,[28] could only sell his machines if he offered his customers a rapid delivery service for spare parts. In 1938, for example, the Kassel-based truck manufacturer Henschel set up its central spare parts warehouse for Germany on the southern motorway ring of Berlin.[29] Every request for a spare part in a repair shop then meant a shipment of general cargo that had to be handled by the railway or truck forwarding companies. Product differentiation, which characterised both the consumer goods markets and the capital goods markets in the 20th century, provided a further impetus for the growth of general cargo transport. In 2015, for example, the Schaffhausen-based company GF Piping Systems will report on its website about a range of 60,000 different products. Product differentiation ultimately leads to the dispatch of smaller quantities down to the individual

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[22] Heinrich Goes: Statistik der Eisenbahnen, Dissertation 1928, University of Frankfurt, p. 78. Goes does not even mention the term general cargo.
[23] Albert Churella: Delivery to the Customer’s Door: Efficiency, Regulatory Policy, and Integrated Rail-Truck Operations 1900-1938, in: Enterprise & Society 10, no. 1, 2009, S. 104.
[24] Esso AG (Ed.): 100 Years Esso, Hamburg 1990, without pagination, year 1896.
[25] Berlin and its Railways, Volume 2, Berlin 1896, Reprint Berlin 1982, p. 349.
[26] Uwe Spiekermann: The basis of consumer society. The emergence and development of modern retail trade in Germany 1850-1914, Munich 1999, p. 295. The dispatch of parcels by the Reichspost in the German Reich rose from 33 million in 1872 to 258 million in 1910, see Hans Rackow : Handwörterbuch des Postwesens, 2. edition, Frankfurt (Main), 1953, p. 469.
[27] Annatina Seifert (ed.): Canned milk and powdered soups - The beginnings of the Swiss food industry, Vevey 2008.
[28] This refers to the sectors of agricultural machinery, construction machinery, vehicle construction, aircraft construction, power stations, electrical engineering, printing technology and medical technology.
[29] The Henschel Star, 1939, issue 4, p. 100.

piece. Just-In-Time delivery, which had shaped car production since the 1980s, also led to growth in general cargo.

The shipment of general cargo initially took place in the railway system and then shifted in the 1920s partly to truck traffic. The construction of motorways in Germany since 1933 facilitated long-distance truck traffic and gave additional impetus to truck-based distribution systems.[30] Due to high financial losses in general cargo transport, the railways in Germany completely abandoned general cargo transport in the 1990s and transferred it to truck transport networks. This policy differs from Switzerland, which continues to carry out general cargo transport by rail.

The rapid growth of general cargo transport since 1890 caused permanent blockages at marshalling yards and goods sheds, where general cargo was transferred from rail to road. Between 1890 and 1940, the railway facilities for freight traffic in Germany were continuously expanded in order to combat congestion.[31] These bottlenecks in freight transport have not yet been taken into account by railway historians. Rather, Heinz Kretschmann, for example, treats the expansion of the Hamm rail junction as if it had solved the blockage problem. The[32] problems in general cargo transport on the railways result from the fact that the amount of work involved in cargo handling is very high, especially since until 1940 (and even later) it was hardly mechanised and the only means available was sack trucks
(see Fig. 4).

Figure 4: Cumbersome transport of general cargo with a sack truck at the loading ramp at a Berlin railway station in 1938. Note the damage to the ramp in the foreground.[33] (Photo Reich Ministry of Transport, released by the railway foundation Joachim Schmidt)

[30] Vahrenkamp 2011, Chapter 7, as Note 12.
[31] Vahrenkamp 2011, Chapter 6, as Note 12.
[32] Heinz Kretschmann: The expansion of the railway network in the Ruhr area in the early 20th century, in: Wilfried Reininghaus (ed.): Verkehr und Region im 19. und 20. Jahrhundert, Paderborn 1999, pp. 295-310.
[33] The damage to the ramp indicates a lack of replacement investments by the Reichsbahn in the general cargo sector.

A report on the Heilbronn goods warehouse from 1937 showed that a goods ground worker moves 200-300 hundredweight a day with a sack truck and travels up to 40 km in the transshipment hall.[34] There is a fundamental difference here between passenger transport and rail freight transport. While people change trains independently and enter or leave the station independently, this is not the case for general cargo. Rather, the general cargo requires manual handling and transport with sack trucks or trolleys within the goods hall.

Small towns, if they were connected to the railway network at all, had only one station.[35] This made it easy to supply them with general cargo. On the other hand, the situation in large cities was complex. Every major city in Germany had a local network of local freight stations in the surrounding area to supply local industry, between which freight cars were moved back and forth to the central marshalling yard, resulting in delays and an unfavourable cost of an expensive locomotive hour (including empty runs) for the movement of a few freight cars. This local network has so far been ignored by research and finds an amazing analogy in the local computer network (LAN). The following pictures show the local networks around Cologne and Stuttgart.

[34] Wir Eisenbahner, Berlin 1937, published by the Deutsche Reichsbahn, p. 92. The figure of 40 km walking per day seems to be exaggerated. The walking distances of the order pickers in the Amazon logistics halls range between 15 km and 28 km per day, see the report on the hall in Phoenix, USA, in the FAZ on 3 November 2015.
[35] In Germany, only about one third of the municipalities were connected to the railway network in 1930, which also served as one of the justifications for the National Socialists' construction of motorways in order to connect more municipalities to supraregional networks, see Richard Vahrenkamp: Der Autobahnbau in Hessen bis 1943, Hessisches Wirtschaftsarchiv, Darmstadt 2007, p. 56. Fritz Todt, later Inspector General for German Roads, pointed this out in his memorandum as early as 1932.

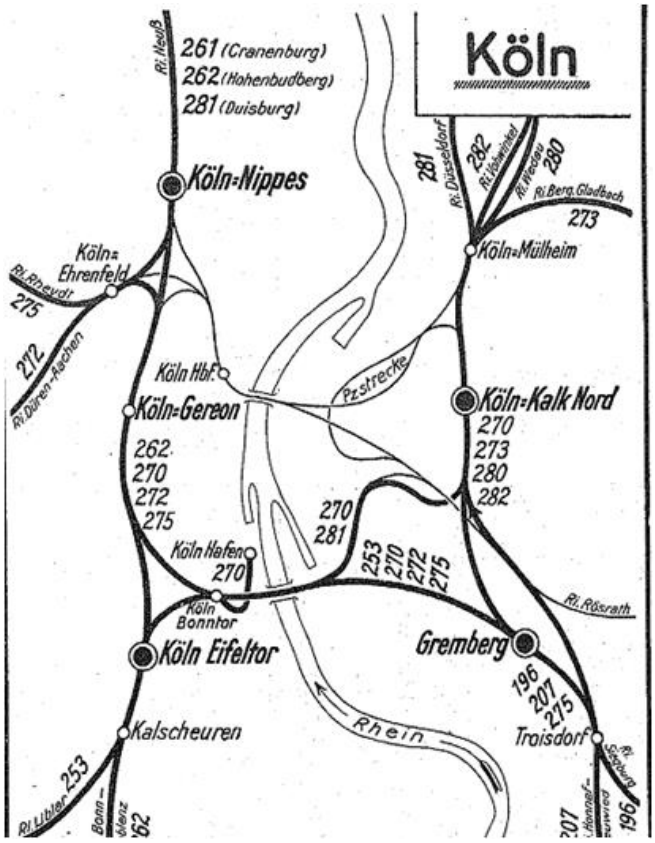

Figure 5: Local network of local freight stations around Cologne (Source: Güterkursbuch 1930)

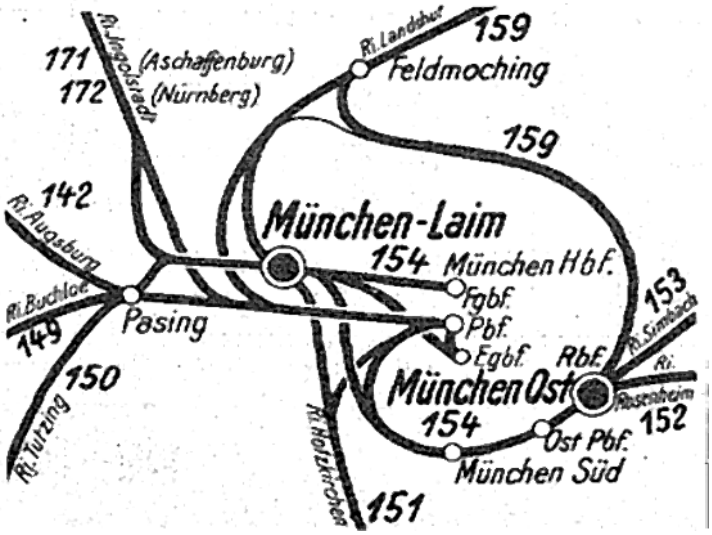

Figure 6: Local network of local freight stations around Munich (Source: Güterkursbuch 1930)

The sheds of the local general cargo stations in the local networks, also known as freight floors, acted as the interface between the track and road infrastructures, as shown in the figure below, and separated the storage areas for dispatch and reception.

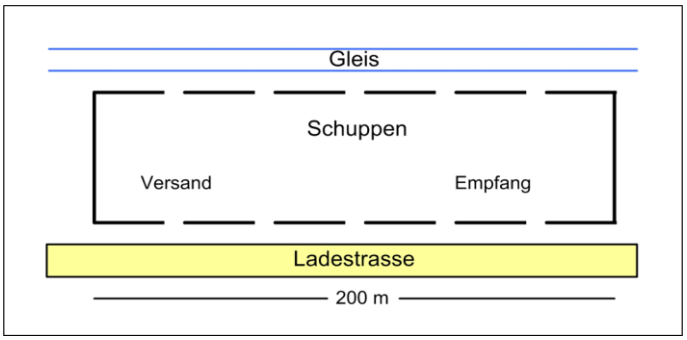

Figure 7: The general cargo shed as an interface between the track and road infrastructures.

The rolling and unrolling of the goods from the shopping street of the local goods station into the surrounding area was carried out by undertakers or rolling services, which until 1940 were mainly carried out by horse-drawn carriages. The following picture shows a scene in front of a shed in Königsberg (today Kaliningrad).

Figure 8: Horse-drawn taxi services on Ladenstraße in front of a shed in Rastatt in 1934 (photo Reich Ministry of Transport, released by the railway foundation Joachim Schmidt).

The general cargo shipment of the railways showed two additional quality levels at increased prices with the categories express freight and express freight. While the express goods could only comprise small and light consignments of up to 30 kg, which were transported in the baggage car by passenger trains, heavier piece goods than express goods could be transported in a special express freight car by passenger trains. With the passenger trains, the dispatch of express freight and express goods enabled fast direct transport between two passenger main stations and avoided the cumbersome processes of general cargo transport. The acceptance counters for express and express goods were integrated into the passenger stations. Large cities had special express terminals near the main railway station, where the attached express wagons were taken and where fresh products, such as

milk or vegetables, were also handled as express goods. The following illustration shows the express delivery hall attached to the Lehrter railway station in Berlin in 1910.

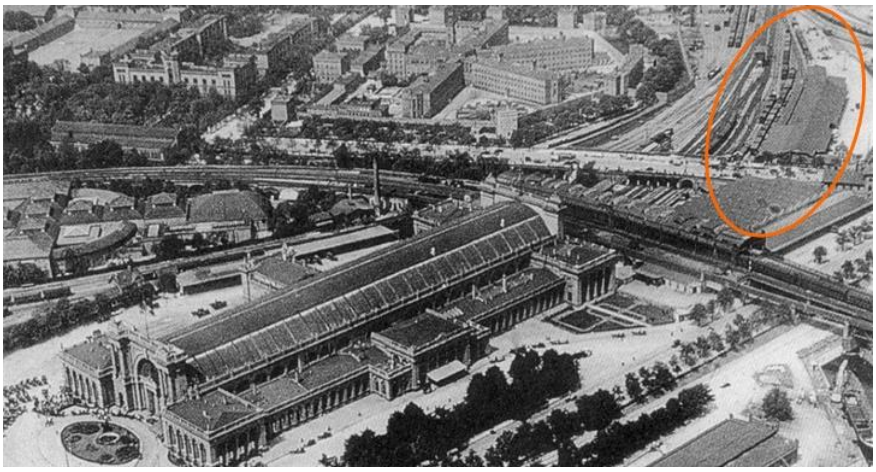

Figure 9: The Lehrter station in Berlin 1910 with the special hall for express goods and milk delivery (marked in red ellipse, source: Wikipedia, Common)

On routes with a high volume of express freight, the railways used special express freight trains that operated between two main passenger stations, but not between two freight stations. Since 1885, the German regional railways have been offering express freight services with an attractive service in competition with Swiss Post for the market segment of parcels. Expressgut could make overnight delivery possible, and the acceptance counters for express goods were even open on Sunday morning.[36] Express shipping developed rapidly. In 1928, Joseph described the sharp increase in express goods traffic since 1900 as "unexpected" and concluded that Christmas traffic to express goods in 1927 had "exceeded all expectations".[37] Express cargo handling at Berlin stations doubled from 31,000 tons in 1913 to 67,000 tons in 1926, resulting in system overloads. However, the sharp increase in express cargo handling to baggage carts worsened service in travel; train departure times were delayed.[38] The following illustration shows the loading of express goods into a baggage car at Berlin Anhalter Bahnhof in 1931. Four officials involved in loading are recognizable, which indicates a high personnel expenditure of the express shipment.[39] Like general cargo, express freight had a complex tariff structure and differentiated between different categories of goods. Reduced tariffs applied to fresh berries, fresh pome and stone fruit, fresh vegetables and fresh edible mushrooms, all

[36] Rinaldini: Express, in: Röll, Baron von: Enzyklopädie des Eisenbahnwesens, Volume 3, Berlin 1912, S. 495-497. Frankl-Hochwart: Expressgut, in: Enzyklopädie des Eisenbahnwesens, published by Freiherr von Röll, Volume 4, 2nd extended edition, Berlin 1913, S. 417-420.
[37] R. Joseph: Expressgut, in: Zeitung des Vereins deutscher Eisenbahnverwaltungen 1928, p. 227-230, here p. 230.
[38] Letter of 14 February 1929 from the head office of the Deutsche Reichsbahngesellschaft to the Reichseisenbahndirektionen, Federal Archives, file R5/20631.
[39] The illustration was made by the railway foundation Joachim Schmidt, Iserlohn, and is approved by the foundation.

of domestic origin, breast milk and its packaging and return to the breast milk collection point.[40] The fact that the railways listed women's milk as a special category indicates a gender aspect in the history of logistics that has so far been ignored.

Figure 10: Loading of express goods at Anhalter Bahnhof Berlin 1931.

The general cargo transports on long-distance routes were linked in a network of 65 huge, 400-metre-long transshipment halls for general cargo. For example, the shipment of general cargo on the Munich to Berlin route was handled in Nuremberg. In the transshipment halls, transshipment was also extremely labour-intensive, little mechanised and time-consuming. The following picture gives an insight into the transshipment hall in Szczecin (today Szczecin) in 1932.

[40] Fahrplan Bundesbahn 1952, Bezirk Nürnberg, S. 8.

Figure 11: General cargo transfer hall in Stettin (today Szczecin) 1932. Note the sack truck in the foreground. (Photo Reich Ministry of Transport, released by the railway foundation Joachim Schmidt)

The following map shows the distribution of the general cargo transshipment halls as red nodes in the Reichsbahn's network of marshalling yards as of 1930.[41] The concentration of transhipment halls in the Saxon industrial area, where the finished goods industry dominates with the dispatch of general cargo, is striking. The same applies to the Rhine-Main-Neckar area, while the dominance of heavy industry in the Ruhr area made only a few reloading halls necessary there.

[41] According to Baumann: Die Bedeutung der Rangierbahnhöfe für das deutsche Verkehrs- und Wirtschaftsleben, in: Verkehrstechnische Woche, Sonderband Rangiertechnik, Berlin, December 1922, pp. 7-11, here p. 8 (also: Blum, Otto (ed.): Rangierbahnhöfe in Ausgestaltung und Betrieb, Berlin: G. Hackebeil, 1922). Reprint of the journal Rangiertechnik, published by the German Federal Railways' Rangiertechnik Technical Committee, Minden 1952, and the Federal Archive Berlin, file R5/20596.

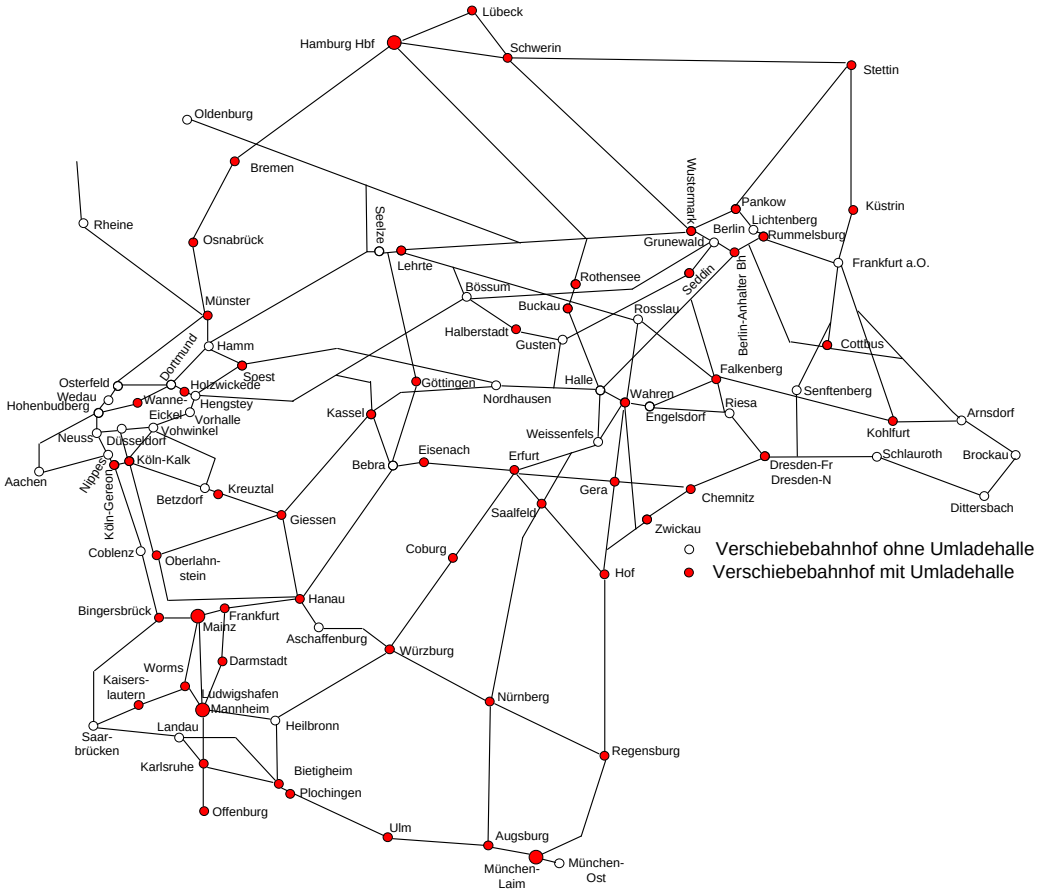

Figure 13: Map of the Reichsbahn's general cargo transshipment halls in 1930.

In the GDR, too, the handling of general cargo caused numerous problems due to a lack of manpower, especially since the degree of mechanization was low in handling and the general cargo sheds of the local freight stations were in some cases over 100 years old and in very poor condition (see Figure 4 for damage to the ramp). As workers on the estates, the GDR employed the lowest social strata - such as prisoners released from prison - at only low wages, which contributed to fluctuation and demotivation and worsened the quality of work.[42] In the GDR, for example, several 100 wagons were temporarily stowed at the sheds without being unloaded. The central and regional transport committees of the GDR repeatedly called for additional day and night shifts to unload the wagons.[43] The lack of spare parts for forklift trucks hindered the mechanisation of general cargo handling in the GDR. Erhard Döhler estimated that unloading 15 tons of general cargo from a wagon without auxiliary means took 270 minutes with four men.[44]

[42] Richard Vahrenkamp: The dream of large-scale truck transport enterprises – early outsourcing experiments in the German Democratic Republic, 1955 - 1980, in: Journal of Transport History, vol. 36, no. 1, June 2015, pp. 1-21.
[43] State Archive Berlin, C Rep. 114/672.
[44] Erhard Döhler: Technological Problems in General Cargo Handling, Der Verkehrspraktiker, Vol. 6, 1964, Issue 1, P. 34. On truck traffic in the Soviet Union see Richard Vahrenkamp: Coping with Shortage and Chaos: Truck Cargo Transport in the Eastern Bloc, 1950-1980, Icon -Journal of the International Committee for the History of Technology, Vol. 22, 2016, no. 1.

Figure 14: Transshipment of general cargo at the goods station of Berlin Central Station in East Berlin in 1959 (Source: Der Verkehrspraktiker, Issue 5, 1959)

During the advance of German troops into the Soviet Union in 1941 and 1942, the General Staff underestimated the problem of unloading 10 daily supply trains, each with 400 tons of general cargo, without the support of forklift trucks, and provided them in insufficient numbers, which contributed to the transport crisis in the winter of 1941.[45]

[45] Klaus Schüler: Logistics in the Russian campaign, Frankfurt 1987.

4 The truck forwarding companies

As general cargo handling built up in the railway system and became long there during transport times, general cargo traffic increasingly shifted to lorries in the 1920s.[46] The data for general cargo handling at the stations of the major German cities clearly show this shift. Compared with the peak level in 1913, the handling volumes in Frankfurt a.M., Solingen and Düsseldorf, for example, were lower in 1927 and 1928.[47]

Rail transport and truck transport differed fundamentally. Railway operation was a system which operated with fixed technical standards and on the basis of extensive manuals of the Railway Operating Regulations. On the other hand, trucks with different technical standards were on the roads, which could drive independently of each other and from fixed timetables at any time. Like the railways, lorries need a special infrastructure consisting of roads, petrol stations and repair services. However, they did not constitute a "system" and could therefore be disposed of quickly, independently of one another and in small units. In the literature examples are given for the urgent supply of Berlin with carp and geese by truck. The journey time between Heilbronn and Cologne was one day in the 1930s (before the motorway was built in Germany[48]) and two days between Heilbronn and Leipzig.[49] The speed of delivery by truck became apparent as early as 1906, when in summer the Parisian daily newspapers were transported by truck to the seaside resorts of Normandy. They arrived there at 8 o'clock in the morning, while the train did not arrive until 11 o'clock.[50]

In the 1920s, many new truck manufacturers entered the market, such as the Kassel-based Henschel company in 1925.[51] To boost their sales, these companies offered trucks to forwarders on an installment basis, which led to low barriers to market entry for forwarders and created a large number of low-capital one-man and one-truck businesses that undercut each other. Since lorry traffic was not yet regulated by law and liability insurance was not yet compulsory, in the 1920s haulage contractors were also regarded as "wild hackers". Both the Chambers of Industry and Commerce and the freight forwarding associations called for measures to fix minimum standards of quality and safety. Even today, safety in Europe-wide truck traffic is still a problem. Every day, the Swiss police

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[46] Alexander Klose: The container principle, Hamburg 2009, p. 46.
[47] Mitteilungen der Industrie- und Handelskammer, Frankfurt a.M, Report on the Year 1928, Part II, Die Wirtschaftliche Lage in den einzelnen Gewerbebranches der Kammerbezirken, p. 347. Economy and Transport, Newspaper of the IHK Düsseldorf, No. 19, 1928, p. 462. Mitteilungen der IHK Solingen, 28. Volume, 1929, p. 166.
[48] Richard Vahrenkamp: The German Autobahn 1920 - 1945 Hafraba Visions and Mega Projects, Cologne 2010.
[49] The long-distance car transport trade, Issue 1, 1930, p. 8f.
[50] Allgemeine Automobil Zeitung, Vienna, 26 August 1906.
[51] Jürgen Nautz (Hersg.): Henschel und Kassel - Case Studies on the History of the Company and the Henschel Family, Darmstadt 2012, p. 136.

reject five trucks with serious defects in tyres and brakes from the passage through the Gotthard tunnel.[52]

When the diesel-powered truck appeared on the market in 1928, according to Humboldt-Deutzmotoren AG, fuel costs fell by 80 % compared with gasoline engines, which also boosted truck sales.[53] Without the external framework of a fixed "system", which was defined by technical standards such as those of the railways, the large number of truck manufacturers and the rapid technical progress in the truck sector ultimately resulted in an extremely heterogeneous truck fleet on the road network with a correspondingly wide demand for spare parts. Rapid technical progress characterized the truck throughout the 20th century and culminated in a multitude of electronic sensors in the driver's cab for monitoring the aggregates and data and voice communication with the home base. The tyre manufacturer Continental, for example, offers a ContiPressureCheck monitoring system that triggers an alarm in the event of tyre problems. [54]

On the other hand, the railways in Germany were increasingly lagging behind lorries in terms of electrical or electronic control and communication equipment in freight trains. To date, it has not at least electronically upgraded its freight wagons into "intelligent freight wagons".[55] Even today, freight trains are checked for proper functioning by the wagon master before departure with hammer blows against the axles and wheels - just like 150 years ago.[56] Intelligent freight cars, on the other hand, have local intelligence with their own computers on board and are equipped with GPS modules, RFID transponders and chips for communication with mobile radio networks. From a technological point of view, they fit into the concept of the "Internet of Things", where freight wagons communicate with each other and with the control centre and exchange data on their status.

For the railway companies, these "intelligent freight car" approaches mean, for example, that freight cars in a freight train communicate with each other and with the locomotive. Then sources of error, such as hot axles, can be reported to the locomotive and the train composition at the marshalling yards can be automated. Jens-Erik Galdiks of SBB Cargo estimates that the Swiss railway company SBB will not deploy intelligent freight cars nationwide before 2050, which supports the thesis of slow technical progress in the European railway companies. The[57] Schaffhausen-based company Savvy Telematic Systems AG is launching the Savvy MultiTrac, a small message box for freight wagons and containers, to upgrade freight wagons with telematics. In addition to tracking & tracing functionalities and inventory checks, the box shows options for circulation monitoring, yard management, shock detection and damage analysis, temperature monitoring and control for

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[52] trans aktuell, 9 October 2015, p. 6.
[53] Deutsche Speditions-und Schiffahrts-Zeitung, Number 3, 1931, P. 41.
[54] Verkehrsrundschau 6 April 2016.
[55] Vahrenkamp 2011, Chapter 12, as Note 12.
[56] See the report by Sebastian Höhn from the Schwedt freight station on September 19, 2014 on Spiegel Online.
[57] Jens-Erik Galdiks of SBB Cargo estimates that SBB will not deploy intelligent freight cars nationwide before 2050, SBBCargo Blog of 5 March 2015. See also the conference of the Swiss company Wascosa in Lucerne on intelligent freight cars in 2015.

containers and refrigerated wagons as well as for recording and displaying wagon conditions, from mileage to flat spot detection.[58]

Shortly before the beginning of the Second World War, the German military recognized the weakness of a heterogeneous truck fleet, which caused problems with the supply of spare parts and repairs in case of war, and tried to reduce these to a few types according to the "Schell Plan".[59] However, this plan did not achieve as much success as planned, since the arms industry relied on the competing private truck manufacturers and had to satisfy their interests with respective quotas of its own truck types - a situation similar to that in the aircraft industry.[60] In addition, the plan came into force so late that the necessary conversions in the factories were not carried out as they would have led to a six-month loss of production. In 1940, in preparation for the French campaign, the military confiscated a heterogeneous fleet of 16,000 trucks from the German economy. However, according to the experience of the Polish campaign, the motorised units were technically very vulnerable. A lack of type restrictions on trucks made it difficult to stock spare parts and there was a lack of repair capacity close to the front.[61]

[58] Telematics Market, issue II/2015, p. 12.
[59] Peter Kirchberg: Typisierung in der deutschen Kraftfahrzeugindustrie und der Generalbevollmächtigter für das Kraftfahrwesen, Jahrbuch für Wirtschaftsgeschichte, Volume 10, Issue 2, S. 117-142. The same: Heeresmotorisierung, Schell-Programm und die Auto-Union, in: Kirchberg, Peter (Hg): Vom Horch zum Munga, Bielefeld 2010. Heidrun Edelmann: Vom Luxusgut zum Gebrauchsgegenstand. The History of the Distribution of Passenger Cars in Germany, Frankfurt 1989, Chapter 6.
[60] Lutz Budrass: Aircraft industry and air armament in Germany 1918 -1945, Düsseldorf 1998.
[61] Hans-Adolf Jacobsen: The Case of Gelb, Wiesbaden 1957, p. 195 and Chapter 22.

5 Parcel services as founders of modern high-performance logistics

The development of modern high-performance logistics, which depends on speed, punctuality and precision, goes back to just-in-time logistics in the automotive industry and parcel logistics. I'm just going into the latter here. Parcels represent a special segment among general cargo. These usually occur in the weight range between 1 kg and 30 kg and have a cuboid shape with a maximum belt dimension of 3 m. The weight range is between 1 kg and 30 kg. A sender in Germany in 1900 could in principle send parcels in five different channels: by rail as general cargo, as express cargo or as express cargo, with the Reichspost or with a freight forwarder who had the parcel transported either by rail or by truck. The Reichspost was able to use postal wagons of the railways, which were attached to the passenger trains, to send parcels. The[62] parallel appearance of parcel channels at the public companies Bahn and Post in 1929 aroused criticism from the savings commissioner, who called for proposals to be combined in the segment over 10 kg.[63]

Post followed the rapidly growing volume of parcels in the Reich's territory, which rose from 103 million in 1890 to 258 million in 1910,[64] and built huge parcel sorting facilities in Hamburg, Berlin, Leipzig, Stuttgart and Cologne between 1895 and 1925.[65] The new Postbahnhof in Leipzig was gradually put into operation in 1912. Eight steel and glass halls spanned 29 tracks, on which 90 railway mail wagons could be placed, and formed one of the largest postal stations in Europe. The following picture shows the halls of the station 1912.

Figure 16: Postbahnhof Leipzig 1912 (Leipziger Illustrirte Zeitung of 5 December 1912, p. 1139).

[62] Lexikoneintrag zu "Eisenbahnpostbeförderung" in Otto Lueger: Lexikon der gesamte Technik und ihrer Hilfswissenschaften, vol. 3, Leipzig 1906, pp. 316-317.
[63] Federal Archives, file R5/20631.
[64] Hans Rackow : Handwörterbuch des Postwesens, 2nd edition, Frankfurt (Main), 1953, p. 469.
[65] Ebenda, keyword mail loading facilities.

In 1911, the city of Leipzig as the source and destination area recorded 10.4 million parcels in outbound traffic and 4.8 million in inbound traffic. It was located in the middle of the German and Austrian postal regions and maintained a constantly growing through traffic of parcels, which already amounted to 36 million parcels in 1912. In 1915, within 24 hours, 300 freight and rail mail wagons were loaded and unloaded in incoming and outgoing traffic.[66] These loading operations were purely manual due to the lack of handling technology. The following picture shows the loaded handcarts on the platform of the Postbahnhof.

Figure 17: Loaded hand carts on the platform of the Leipzig Postbahnhof 1912
(Source: Leipziger Illustrirte Zeitung of 3 December 1912, p. 1140).

All Postbahnhof stations have been closed since 1995 and today some of them serve as venues with a nostalgic touch for events, such as the Postbahnhof at Ostbahnhof in Berlin and the Postbahnhof in Stuttgart at Park Rosenstein.

The private general cargo forwarders of the old Federal Republic of Germany (BRD - 1949 - 1990) moved 150 million parcels in 1972.[67] For these transport companies, it was therefore obvious to develop a special distribution system for the parcel segment, especially since the standardised characteristics of a parcel were ideally suited to "industrialising" parcel handling: the easy-to-handle segment of parcels was separated from the objects that were difficult to handle, such as barrels, tyres, extremely long goods and extremely heavy goods, and highly automated technologies for sorting parcels were developed. In the sorting halls, parcels were placed on treadmills and discharged

[66] Newspaper of the Association of German Railway Administrations, 1912, p. 1367f. Leipziger Illustrirte Zeitung of 5 December 1912. Wolfram Sturm: Railway Centre Leipzig, Leipzig 2003, p. 54f. Michael Reinboth and Siegfried Marsteller: From Leipzig Post Office 18 to Radefeld Freight Post Centre, in: Post- und Telekommunikationsgeschichte, Issue East, Issue 1, 1997, pp. 3-23, here pp. 5f.
[67] Peter Badura: Der Paketdienst der Deutschen Bundespost, Jahrbuch der Deutschen Bundespost 1977, p. 120.

into the designated destination channels with tilting trays. Scanners recognized the barcodes on the parcels and controlled the treadmill. The following figure shows these sorting processes with a view into a sorting hall in 2011.

Figure 17A: Automatic sorting in a DHL parcel sorting hall in 2011
(DHL press photo).

The otherwise restrictive Postal Act in Germany, which protects the monopoly of the postal service, surprisingly left a gap open for private parcel services. It used UPS, a US parcel service that entered the German market in 1975. This was followed in 1976 and 1989 by the two medium-sized cooperation networks DPD and GLS, which founded private parcel services. These associations each consisted of approx. 20 medium-sized truck forwarding companies, which covered the Federal Republic of Germany with their catchment areas, set up groupage and distribution transports for parcels there and understood the association as an umbrella brand for a uniform appearance and a uniform pricing policy. The networks used central hub transhipment facilities in the Bad Hersfeld - Aschaffenburg area as the geographical centre of the old FRG and were able to compress the delivery time to less than 24 hours, while in the general cargo area three days were still usual. This geographical centre also became the centre of reunified Germany, so that the sorting facilities located there could be taken over almost seamlessly into reunified Germany.

An important network type for parcel services is the **hub-and-spoke network** (see Figure 18), which Federal Express introduced to the US logistics industry in 1973 as an innovative concept. This network form strongly reminds of a wagon wheel with a central hub and several spokes. In the hub system, shipments from the regional warehouses are delivered at night to a central transshipment depot, also known as a hub, where they are sorted by destination and then transported to the regional transshipment depots (spokes) in the form of a star. As a result of this organisation, sorting is only carried out at one central location in one operation.

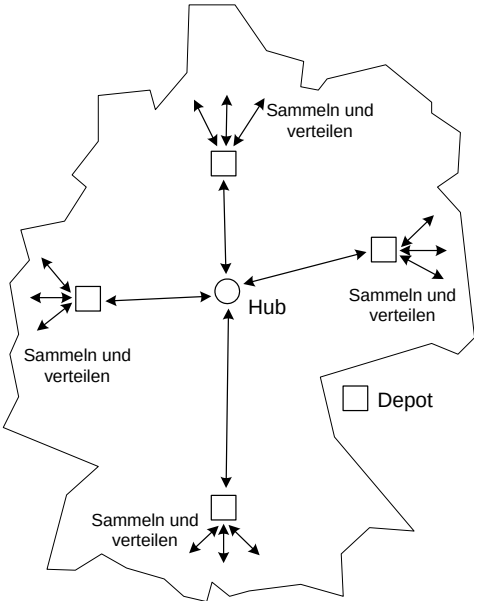

Figure 18: The hub structure in parcel networks in Germany

The hub and spoke system introduced Frederick Smith to parcel logistics, which has been practiced in passenger aviation for decades. He had already worked out the inadequacies of the airfreight companies' line system in 1965 in a seminar paper at Yale University. Smith and his company Federal Express set up an overnight parcel service for the USA, connecting almost all places that were new and revolutionary for this country with great distances.

Frederick Smith's concept for the overnight delivery of parcels with Federal Express initially created a unique position on the American freight transport market. There was no service there with comparable characteristics. Although the UPS parcel service had an excellent nationwide door-to-door parcel transport network, it was unable to offer an overnight service over long distances due to its street orientation. The air freight carriers and forwarders did not offer a continuous door-to-door service or really reliable, clear and simple service standards. The basic ideas of Federal Express can be summarized as follows:[68]

- Product standardization: The new service should be limited to packages of up to 24 kg. This is the area where most very urgent freight and document shipments occur.
- Avoidance of state regulation: The strict regulation of air and road freight traffic, which was still in place at the time, was circumvented for the air line and road area network by exclusively using small aircraft (Falcon jets), which were not licensed as air taxis, and minibuses.
- The hub-storage transport network: In order to be able to work with the greatest reliability and efficiency at relatively low volumes at first, the entire handling operation and administration was placed at one point - Memphis Airport. Memphis is located in the geographical centre of the USA. There, idle airport capacities could be used cheaply. Every economic center of the USA can be reached there in less than 4 hours flight time. Memphis has good weather conditions and no airspace overcrowding problems. Each shipment was

[68] Peter, Klaus: Federal Express Corporation, in: GVB-Information 12 (1988), No. 3, p. 18f.

flown by 30 Falcon jets from each of the 50 or so spoke stations in the most important conurbations of the USA to Memphis in the early evening, where it was transshipped between 11 p.m. and 2 a.m. and brought to the target spoke stations in a second wave of flights in time for the start of the delivery tours. A package from Boston for the city of Washington D.C., 500 km away, was then flown over the central hub in Memphis, covering some 3000 km. But it was already in 16 hours at the receiver.

- Simple and clear tariff structures and accompanying documents: A simple, clear tariff and accompanying document system, which contains no hidden additional costs, was designed.

After Federal Express went into operation in 1973, further innovations and continuous improvements followed:

- Electronic shipment tracking: The reliability and controllability of the system was enhanced with state-of-the-art communication and data processing technology (tracking and tracing). Delivery data with the name of the confirming party can be retrieved system-wide in minutes after the delivery date.
- Computer-optimized route planning: The electronic connection between vehicles and the central computer system has been developed in such a way that incoming pick-up orders during the day are given to the vehicles at the same time as the newly optimized route planning.
- Telephone Customer Service: Federal Express has a customer service system where calls are routed to regional service centers where they are centrally handled under strict quality control.
- Expansion of the network: With the deregulation of air and road traffic in the USA in 1978/80, the use of air taxis and buses was no longer necessary. Jumbo freighters and several regional hubs have since supplemented the system.
- Business Service Center and Drive-Through Delivery Station: As the density of the system increases, self-service and drive-through delivery stations have been established in office centers and metropolitan areas.

At the beginning of 1988, Federal Express had 50,000 employees worldwide and operates 17,000 surface vehicles and 155 aircraft. Turnover in 1987 was $3.1 billion. Federal Express continued to record very high growth rates.

The general cargo forwarding company Schenker took over the hub concept for land transport by truck from the parcel services and set up a central hub for the general cargo sector in Friedewald near Bad Hersfeld in 1994.[69]

The success of private parcel services in Germany was reflected in high growth rates over many years. This was also due to a new pricing policy towards traditional general cargo forwarders. While

[69] Vogeler, Johannes: Logistical network configuration through hub system at Schenker Deutschland AG, in: Prockl, Günter: Development paths and milestones of modern logistics: outlines of a roadmap, Wiesbaden, 2004, pp. 158-179.

the latter issued three invoices to the consignee for the shipment of a piece of cargo, namely for groupage, distribution and the main leg of the long-haul journey, the private parcel services issued one invoice based on uniform price tables based solely on weight. Private parcel services have shown high growth rates over the past 30 years. DPD and GLS each generated more than €1.3 billion in turnover in 2009.[70] The author's expectation that a single parcel market would emerge in Europe, as in the USA, has not been fulfilled. On the contrary, the national parcel markets remained independent of each other, with different durations and offers. The delivery times between the countries of the EU are quite different. Leipzig Airport has developed into an international parcel hub for the German parcel service DHL within the postal group, from where aircraft connect the Leipzig parcel hub with other continents.[71]

Due to its geographical size, Germany is particularly suitable for overnight parcel services. The distance Hamburg-Munich is about 800 km and can be covered with a truck in 11 hours, assuming an average of 80 kilometres per hour, including breaks. Therefore the network type Hub-and-Spoke can be operated in Germany. The situation is different in countries such as France, Italy or Spain, where the main axes can no longer be crossed in one night. Therefore, the Next-Day Service cannot be displayed for all relations with groundbound transports in these countries. However, in Italy there is a concentration of economic activity on northern Italy, so that a hub network can supply the Turin-Milan-Rome region with a Next Day Service. The situation is similar in France. Some extreme distances cannot be covered overnight with a hub concept, such as Bordeaux-Mühlhausen with 950 km or Paris Northwest Nice with 890 km. With a hub in Orleans, all important economic centres in the north and east of France can be reached within a distance of 400 km. However, this does not apply to Marseille and Nice.

In the 1970s, private parcel services took a leading position in the development of 'modern logistics' - high-performance logistics. They were the first industry in Europe to set up a networked IT infrastructure in their branches and used the barcode on the parcels to generate an information stream from the parcels' flow of goods via scanners, which virtually mapped the parcel flow. The automotive industry did not follow this concept for incoming goods until the 2000s. However, international air freight has not used continuous barcodes until today. The movements of the parcels in the distribution system of the parcel services left traces of time and place marks in their computer systems via the scanners, which made it easy to detect and correct incorrect loading, losses and theft. The parcel services were thus the first industry to formulate and implement high standards of quality in the provision of services. Speed and freedom from errors were the hallmarks of this logistics quality, while rail logistics was characterised by long delivery times and damage to the goods.

[70] Vahrenkamp and Kotzab 2012, p. 159, as Note 17.
[71] Richard Vahrenkamp: Global air freight networks. Terms and structure, Hamburg 2014.

5.1 Continually growing CEP markets in Germany

The strong growth of the CEP sector, which could be observed in Germany in the 1990s, continued almost unabated until 2014. The average annual growth of the CEP sector from 2000 to 2014 was 3.6% in the number of shipments, accelerating to 4.1% from 2004 and even to 4.5% from 2010. The impact of the expanding parcel market through e-commerce is noticeable here. According to the BIEK, the total sales volume of the CEP market in 2014 amounted to approx. 16.6 billion €, i.e. 66% above the level of 2000. The number of shipments p.a. of the CEP sector until 2014 is shown in Figure 1, where the economic slump caused by the financial crisis in 2009 led to a slight decline. Almost four billion consignments p.a. are expected by 2020.

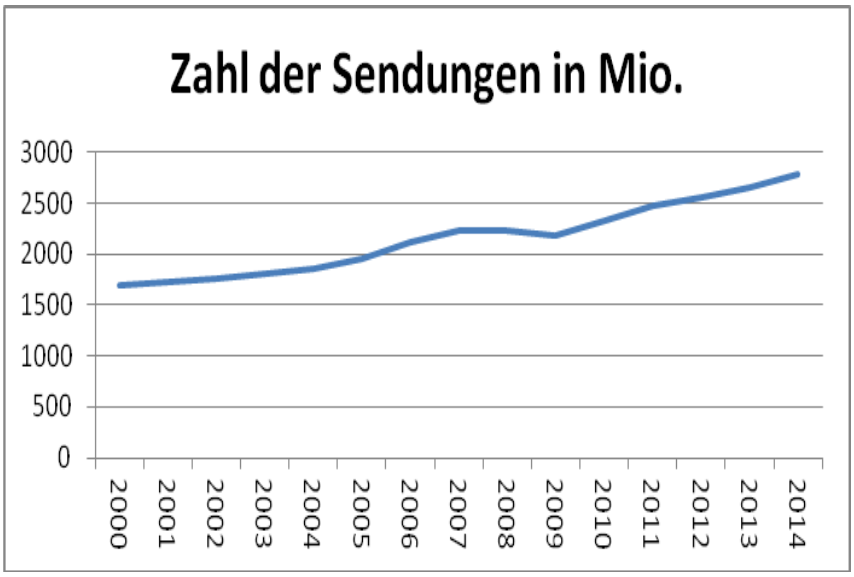

Figure 1: Development of CEP programmes since 2000 (Source: BIEK study 2015)

If one examines the relationship between GDP growth and turnover of the CEP sector in Germany, one finds a close relationship, which is shown in Figure 2. The trend line through the data points of the time series of GDP and CEP turnover from 2000 to 2014 indicates that a CEP turnover of € 9 million is generated per billion of additional GDP. Remarkable is the very high coefficient of determination of 98%, which indicates the particularly close relationship between the two time series. Figure 2 shows a longitudinal analysis of the CEP sector from 2000 to 2014 in contrast to Figure 4, which carries out a cross-sectional analysis of all European countries at the time of 2011.

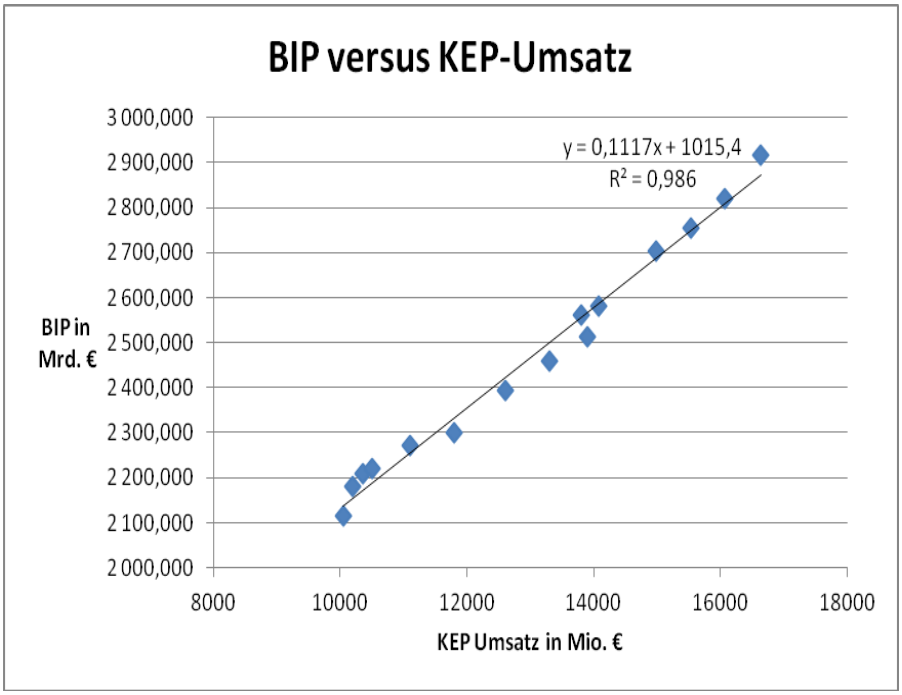

Figure 2: Correlation between GDP and CEP turnover in Germany 2000 to 2014
(Source: BIEK Study 2015 and Federal Statistical Office, GDP in current prices)

The parcel markets in Europe

Unlike the US, there was no single market for parcel services in the EU. Rather, the markets remained national and were linked to individual interfaces. Countries whose dimensions can be measured with a night trip with a lorry, such as Germany, build up the domestic distribution of parcels essentially with lorry-supported systems. For premium parcels, which are due to arrive at the recipient's at 9:00 a.m., the CEP services connect the long haul in Germany, such as Hamburg with Munich, with small aircraft. Countries with long distances, such as Russia, Poland, Italy, Spain and France, use additional domestic flights. The parcel transports between the countries in Europe are constituted by truck with a transit time of 48 to 72 hours. Aircraft handle urgent connections in Europe in a network of major integrators UPS and FedEx. An aircraft from FedEx leaves Berlin for Paris at 21:45 on weekdays. The exchange of parcels between the capitals of Europe takes place in only small quantities. Small turbo aircraft ATR 42 with a capacity of 4 tons or the ATR72 with 7 tons are used. At UPS's European hub in Cologne, less than 7 tons of parcels from all over the world arrive every working day from Berlin and the surrounding area, arriving in Berlin with an ATR72 at 5.35 in the morning.

Figure 3 shows how the market shares of the European parcel market - with a volume of 42 billion euros - will be distributed among the individual countries and types of dispatch in 2011, including Turkey (TR). The parcels market is clearly focused on Western Europe. Brussels thus has an ideal central location in the densely populated triangle London - Paris - Cologne to minimise the transport distances in the European network. The integrator DHL therefore had its European hub in Brussels until 2008. In 2011, the integrator DHL served 85 airports across Europe with 92 aircraft. According to Figure 3, the Benelux countries send the highest proportion of parcels internationally at around 60%, which reflects the strong integration of the Netherlands and Belgium into the world economy, while

France, Germany, Spain and England send less than 30% internationally. In Italy the share is again higher at 39%.

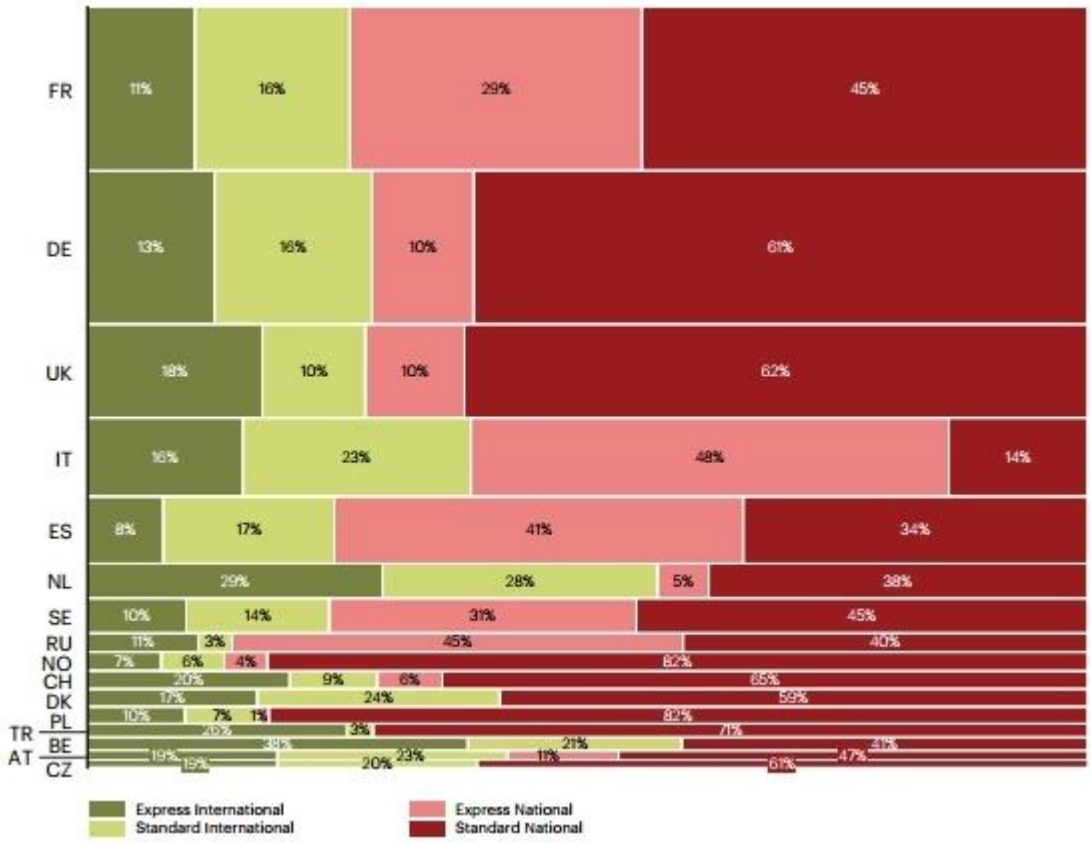

Figure 3: The parcel market in Europe in 2011 by country and shipping method
(Source: A. T. Kearny, press release of 30. 11. 2011)

According to the data in Figure 3, Table 1 shows the turnover of the parcel markets in the individual countries and relates it to the population and gross domestic product (GDP in US dollars). The table is sorted by the turnover of parcels in million euros per million population. We can see how the Scandinavian countries are at the top of the table, followed by France and the Netherlands. These countries have the highest per capita turnover of parcels. If one considers a correlation between parcel turnover and population in Table 1, only a very weak correlation becomes visible with a coefficient of determination of only 16%. The populous countries Russia and Turkey have only a low parcel turnover and thus reduce the degree of certainty.

country	Turnover of parcels per million population in million euros	Parcel turnover in billion euros[72]	Population in million	GDP in US$ billion	Turnover in parcels per billion GDP $
Norway	194,6	1,0	5	483	1,0
Denmark	194,6	1,0	5	333	1,0
Sweden	180,2	1,6	9	538	1,6
France (France)	141,9	9,1	64	2776	9,1
Netherlands	121,6	1,9	16	840	1,9
Switzerland	121,6	1,0	8	636	1,0
Germany (German)	109,5	8,8	80	3577	8,8
England	82,4	5,2	63	2417	5,2
Austria	81,1	0,6	8	419	0,6
Spain	77,6	3,6	46	1493	3,6
Belgium	73,7	0,8	11	513	0,8
Italy	70,3	4,2	60	2198	4,2
Czechia	64,9	0,6	10	215	0,6
Poland	21,3	0,8	38	513	0,8
Turkey	11,6	0,8	70	778	0,8
Russia	6,8	1,0	143	1850	1,0

Table 1: Package turnover by country, population and GDP in 2011

The following correlation of Figure 4 shows the relationship between parcel sales and GDP of the data in Table 1 for the countries in Europe in 2011 and thus represents a cross-sectional analysis. Here a close connection becomes visible with the coefficient of determination of 83%. For every additional billion $ GDP, a parcel turnover of 3.0 million euros is achieved, as the degree equation shows. It can therefore be argued that the parcel markets reflect a country's level of economic development. This connection was already visible before the Internet age. A west-east comparison showed that the Eastern bloc was lagging behind in the package indicator. While 198 letters and 4.3 parcels were sent per capita in the Federal Republic of Germany in 1980, these values for the USSR were 35 letters and 0.9 parcels.[73]

[72] Data according to Table 1.

[73] Statistical Yearbook for the Federal Republic of Germany, 1983, p. 303, and the Russian Statistical Yearbook (Narodnoe Chozjasstvo SSSR) for 1990, p. 630.

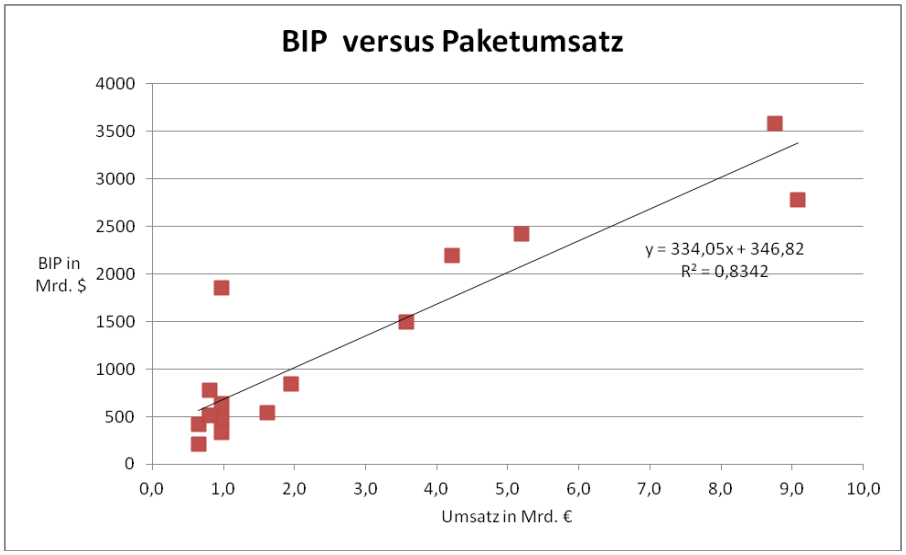

Figure4: Correlation of GDP and parcel sales across European countries in 2011.