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Report 14 (2021)

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Economic significance of the German rail sector based on employment impact

Summary

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On behalf of the German Centre for Rail Traffic Research at the Federal Railway Authority

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Table of contents

Brief description / Abstract

This study is the first to provide a comprehensive overview of the economic significance of the entire German rail sector based on its impact on employment. The results are broken down at the level of six clusters and in even greater detail at the level of 30 sub-sectors such as railway undertakings (RUs) in passenger transport. The analyses, of the study conducted on behalf of the German Centre for Rail Traffic Research at the Federal Railway Authority, refer to the cut-off date of December 31, 2019. The study was conducted between August 2020 and June 2021 by the market research service provider Statista in collaboration with Prof. Dr. Christian Böttger and Prof. Dr. Wolfgang Maennig.

The rail sector in Germany secures employment of a good half million full-time equivalents (FTEs). This includes direct employment effects which amount to 397,600 FTEs in the clusters under consideration:

- Railroad operation,
- Railroad infrastructure,
- Production, maintenance and rental of rolling stock,
- Combined transport (CT),
- Research, supervision, public transport authorities and transport associations and
- Other services in the railroad sector.

In addition, there are indirect employment effects of 152,400 FTEs from the purchase of intermediate inputs in upstream stages of the value chain in Germany. Of these, 90,400 FTEs result from the direct procurement of goods and services by companies from the rail sector from upstream suppliers (first-round effect) and a further 62,000 FTEs result from other employment effects in the upstream value chain (value chain effect).

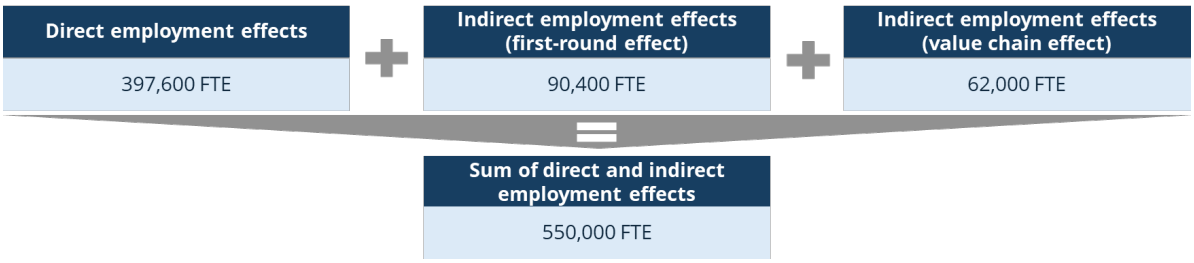

Figure 1: Direct and indirect employment effects of the rail sector in Germany (FTEs - full-time equivalents)

Other employment effects, such as induced employment effects from consumption by those employed in the rail sector, and in upstream value-added steps, were analysed as part of the study but are not included in this figure.

A proven method mix of secondary and primary research was used to carry out the research project. The core element was a direct survey of companies from the rail sector. In total, 58 percent of the direct employment impact recorded in the study could be traced back to the 219 companies that participated in the survey.

The survey also looked at other topics such as expectations for the future. The majority of the companies surveyed have a positive view of the future with a time horizon of ten years and expect both higher transport volumes and higher employment. However, against the backdrop of the shortage of skilled workers that already exists in many areas of the rail sector, this also presents challenges.

1 Employment impact of the rail sector

1.1 Delimitation of the rail sector

At its core, this study captures directly rail-dependent employment at the sub-sector level. The core elements are employment that is directly dependent on rail, including employees involved in the operation of rolling stock, the associated infrastructure, the production of rolling stock or rail infrastructure systems and components, and other services directly related to rail transport. In the context of this study, this employment is divided into six clusters, to which 30 sub-sectors are assigned.

The **railroad operation** cluster **(A)** includes those sectors that are directly related to the transportation of people or goods and usually have their own rolling stock:

- Railway undertakings (RUs) passenger transport
- Railway undertakings (RUs) freight transport
- Local public transport train operators (metro, streetcar and light rail)
- Factory and connecting railroads
- Railroad tourism companies
- Museum railroads

The **railroad infrastructure** cluster **(B)** brings together industries involved in the operation, organization, construction, and maintenance of railroad infrastructure:

- Railway infrastructure managers
- Siding owners
- Track construction companies
- Manufacturers of railroad infrastructure systems and components incl. suppliers

The **rolling stock** cluster **(C)** includes manufacturers of rail vehicles and companies that provide services related to rail vehicles:

- Wagon lessors / owners
- Locomotive leasing / locomotive rental companies
- Workshops (incl. workshops for local public transport trains)
- Manufacturers of rail vehicles incl. suppliers

The **combined transport** cluster **(D)** includes companies of combined transport (CT) with rail:

- CT transshipment facility operators
- CT operators
- Rail forwarders

Research, supervision, public transport authorities and transport associations (E) are brought together in a cluster. These employees form the framework for development, training and regulation and are thus directly linked to the rail sector:

- Higher education institutions
- Research facilities
- Transport authorities / transport associations
- Authorities

The **other services** cluster **(F)** includes the sub-sectors which are responsible for the technical development in the rail sector, contribute to the smooth running of the industry, or provide services with a direct effect on railroad customers:

- Railway station trade
- Railroad staffing services
- Consulting companies
- IT service providers
- Engineering offices / consultants
- Certification bodies
- Vocational training and continuing education institutions
- Personal and object protection as well as track marshals
- Cleaning companies

1.2 Direct employment effect

The direct employment impact of the rail sector is 397,600 FTEs. The railroad operation and railroad infrastructure clusters have the highest employment share and together account for just under 60 percent of employees in the rail sector. The figures calculated are rounded to the nearest hundred employees in each case. Individual discrepancies between the totals of the employment impact of individual sub-sectors and reported aggregate figures result from rounding differences.

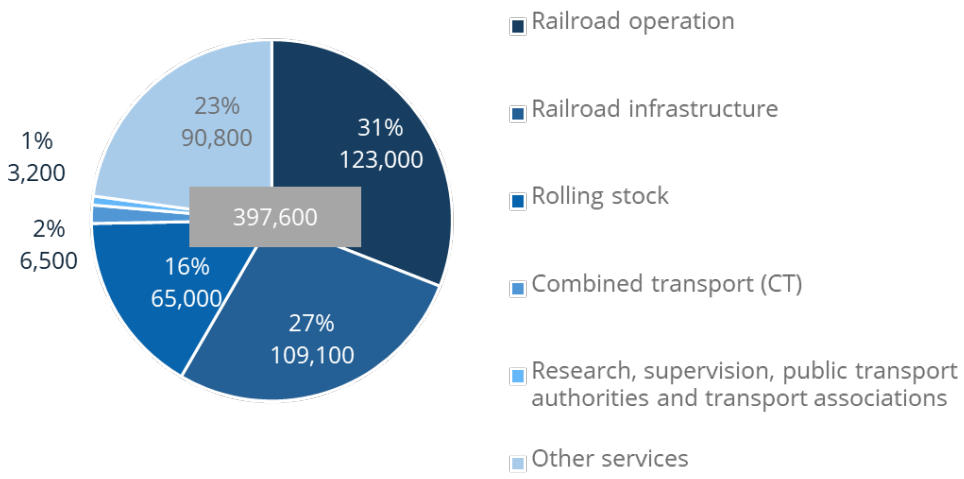

Figure 2: Direct employment impact in FTEs by analysed clusters

TABLE 1: DIRECT EMPLOYMENT IMPACT OF THE SUB-SECTORS IN THE RAIL SECTOR

#	CLUSTER	#	SUB-SECTOR	FTE
A	Railroad operation	1	RUs passenger transport	62,800
		2	RUs freight transport	24,500
		3	Local public transport train operators (metro, streetcar and light rail)	30,300
		4	Factory and connecting railroads	5,200
		5	Railroad tourism companies	200
		6	Museum railroads	100
B	Railroad infrastructure	7	Railway infrastructure managers	66,600
		8	Siding owners	1,800
		9	Track construction companies	21,300
		10	Manufacturers of railroad infrastructure systems and components and their suppliers	19,400
C	Rolling stock	11	Wagon lessors / owners	1,100
		12	Locomotive leasing / locomotive rental companies	400
		13	Workshops (incl. workshops for public transport trains)	30,800
		14	Manufacturers of rail vehicles and their suppliers	32,700
D	Combined transport (CT)	15	CT transshipment facility operators	2,900
		16	CT operators	1,800
		17	Rail forwarders	1,800
E	Research, supervision, transport authorities, transport associations	18	Higher education institutions	200
		19	Research facilities	200
		20	Transport authorities / transport associations	1,000
		21	Authorities	1,900
F	Other services	22	Railway station trade	32,800
		23	Railroad staffing services	7,700
		24	Consulting companies	900
		25	IT service providers	6,900
		26	Engineering offices / consultants	12,100
		27	Certification bodies	2,900
		28	Vocational training and continuing education institutions	1.300
		29	Personal and object protection as well as track marshals	17.700
		30	Cleaning companies	8.500

1.3 Indirect employment effect

Indirect employment effects arise from the purchase of intermediate inputs in upstream sectors. These can be divided into first-round effects and value chain effects. The first-round effect includes the effect of the resulting employment from the procurement of intermediate inputs by companies in the rail sector from direct suppliers. For example, such an effect results when a manufacturer of rail vehicles purchases intermediate products from a manufacturer of metal products. The value chain effect results from the further procurement of intermediate products along the entire value chain. For example, the manufacturer of metal products procures input products from a steel manufacturer, which in turn procures input products from an energy company, and so on.

Double counting of employment effects due to the strong cross-relationships between the sub-sectors in the purchase of intermediate inputs was eliminated. For example, the investment of a railway undertaking (RU) in a rail vehicle results in an indirect employment effect. However, since employment at manufacturers of rail vehicles is already recorded as direct employment in this study, the indirect employment effect was not taken into account.

The first-round effects of the rail sector on employment in upstream industries amount to 90,400 FTEs. Rail vehicle manufacturers record the largest first-round effect, with an indirect employment effect of 22,800 FTEs through the purchase of inputs from direct suppliers. Important upstream sectors for this sub-sector are, for example, service providers in the area of employee leasing and manufacturers of metal products.

The value chain effect of the rail-dependent sectors is associated with employment of 62,000 FTEs.

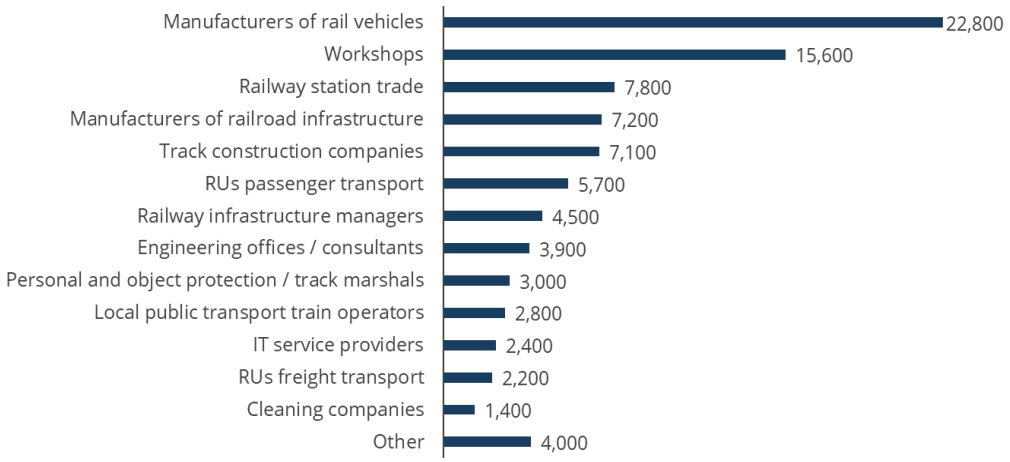

Figure 3: Indirect employment effect (first-round effect) in FTEs by sub-sector

1.4 Complementary insights

In addition to information on employment effects, also data on personnel measures in the context of the Corona pandemic, skills shortage and future prospects was collected in the survey. These information provide a strategic perspective and a broader picture of the industry in context of the employment effects. In the following, selected highlights of the results are shown.

1.4.1 Personnel measures in the context of the Corona pandemic

The Corona pandemic was also a drastic event for the rail sector, to which over a quarter of the companies surveyed responded with short-time work. Manufacturers of rail vehicles and their suppliers, as well as railroad staffing services and the railway station trade, made particularly strong use of short-time work, each with over 60 percent.

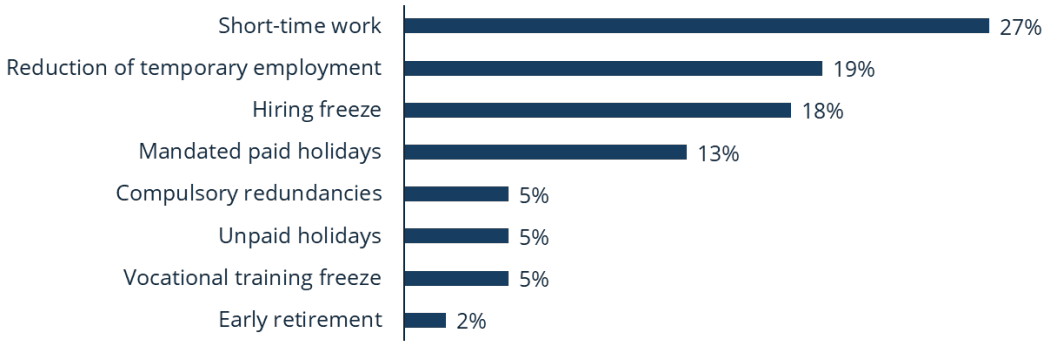

Figure 4: Personnel measures implemented due to the Corona pandemic

It is also striking that 56 percent of large companies (250 or more employees) have resorted to short-time work, while just over 15 percent of small and micro companies (50 employees or less) have used this instrument. At 26 percent, a considerable proportion of large companies have also imposed hiring freezes. By contrast, a high proportion (10 percent) of microenterprises (fewer than ten employees) responded to the pandemic with compulsory redundancies.

1.4.2 Proportions of employment by vocational qualification

As part of the study, the primary survey also collected the shares of employment by vocational qualification. The distribution of vocational qualifications is relatively similar in the railroad operation, railroad infrastructure, rolling stock, and combined transport clusters. By far the largest group in these clusters are employees with recognized vocational training (about 60 percent each). In addition, there are 9 - 16 percent master craftsmen and technicians. The research, supervision, public transport authorities, and transport associations cluster is dominated by employees with an academic degree (76 percent of employees).

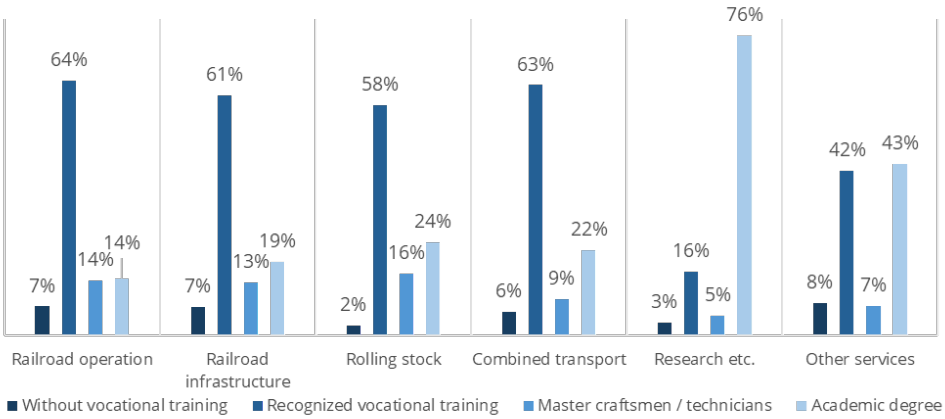

Figure 5: Proportion of employees by vocational qualification in the clusters

The cluster of other services is heterogeneous. In the companies that participated in the survey, employees with academic and recognized vocational qualifications make up the majority of employees (a good 40 percent each). It should be noted, however, that companies from the employment-intensive sub-sectors of railway station trade, personal and property protection / track marshals and cleaning companies are hardly represented in the survey and the survey results are therefore not meaningful for the sub-sector as a whole.

1.4.3 Skills shortage

The rail sector is characterized by a shortage of skilled workers. In the clusters of rail operation, rail infrastructure, rolling stock, combined transport and other services, around three quarters of the companies surveyed answered the question: "Does your company have problems recruiting/finding skilled workers? " with "Yes " or "Rather yes." In the research, supervision, public transport authorities and transport associations cluster, the situation is somewhat less tense, with just over 50 percent of the companies surveyed saying "Yes" or "Rather yes".

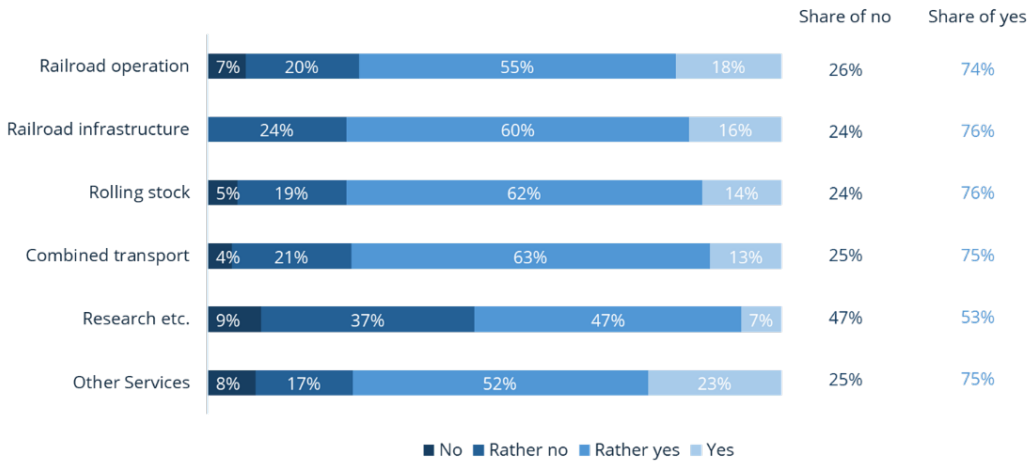

Figure 6: Proportion of companies having problems finding skilled workers

1.4.4 Future prospects

Regarding the change in their own rail transport volume over the next ten years, most companies in the rail sector expect an increase. This applies both to companies that are active in freight transport and to companies that provide passenger transport services. When comparing these two sectors, the picture is even more positive in freight transport. Here, 80 percent of the companies surveyed expect a higher or even significantly higher transport volume. In passenger transport, on the other hand, only 59 percent of the companies surveyed expect an increase, while as many as 11 percent of the companies anticipate a reduction in their own transport volume.

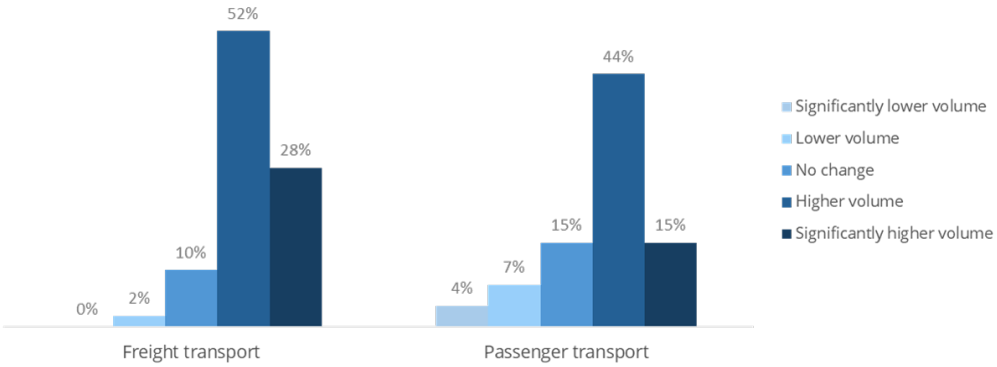

Figure 7: Future expectations for own transport volume by rail in ten years

These positive expectations for the future are also reflected in the expectation of changes in employment over the next ten years. In all clusters, many of the companies surveyed expect higher employment in the future. It is interesting to note that the prospects for the industry are assessed as better than those for the company itself. A comparison of sizes shows that smaller companies expect employment to rise more sharply, while among companies with more than 50 employees, as many as 19 percent of the companies surveyed across all clusters expect lower employment.

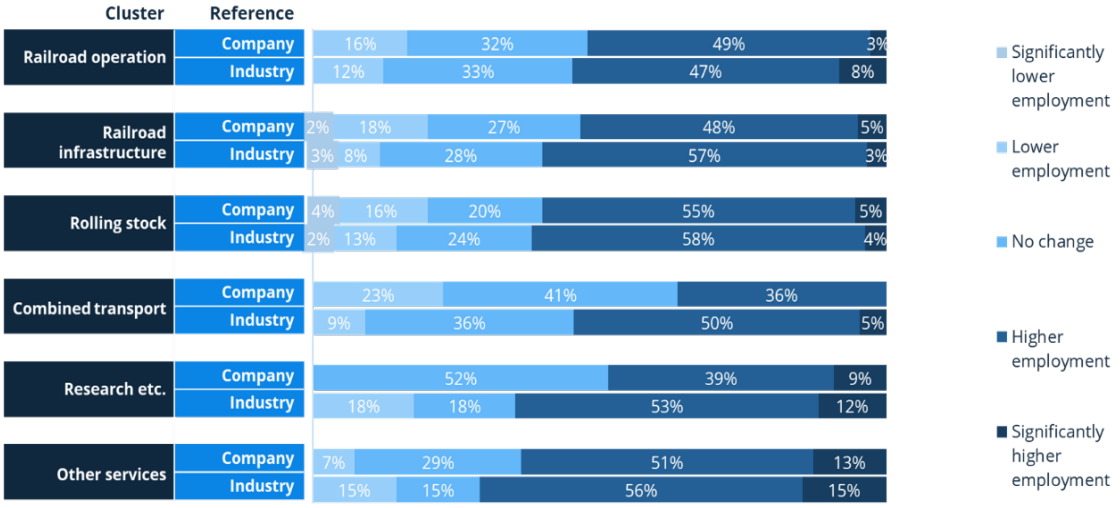

Figure 8: Future expectation of employment in ten years

2 Methodology

The objective of the project was to assess the employment of companies in the rail sector and furthermore to assess the distribution of employment of the individual companies among the considered sub-sectors within the rail sector and, if relevant, among activities outside the rail sector. For this assessment, a combination of secondary and primary research was used.

The core element of this research was a direct survey of companies from the rail sector. In total, data from 219 companies could be collected directly. The employment impact of these companies in the rail sector is approximately 230,000 FTEs. This means that 58 percent of the direct employment impact of 397,600 FTEs recorded in the study can be attributed to data directly provided from companies in the sector. In addition, almost 2,000 further companies from the rail sector were identified. For these companies, the number of employees was collected from company databases. In the case of larger companies and those of particular relevance in individual sub-sectors, the distribution of the employment impact across sub-sectors and activities outside the rail sector was analysed individually, for example on the basis of data from the annual report, from the company website or expert assessments. 10 percent of the total direct employment impact is based on this individual company analysis. For other companies, the distribution of employment impact across sub-sectors was done through a similarity analysis to companies for which data was available from the primary survey or the individual analysis. Overall, 19 percent of the direct employment impact in the rail sector was identified via the similarity analysis. In addition to this detailed bottom-up analysis, top-down estimates were also made for individual sub-sectors, e.g., based on other studies or expert assessments. 13 percent of the direct employment impact in the rail sector is based on top-down analyses.

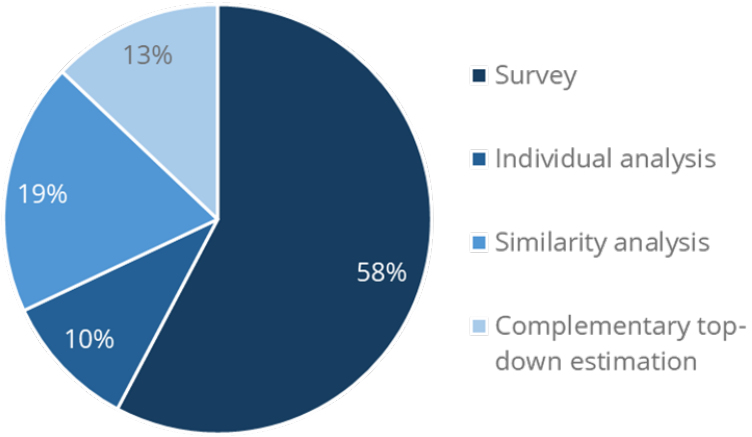

Figure 9: Proportion of direct employment effect recorded according to methodology

In addition to calculating the direct employment effect, the study also determined indirect effects through intermediate inputs. The input-output table of the Federal Statistical Office for Germany was used to calculate indirect effects. A special feature of the study was that many indirect employment effects due to intermediate inputs of individual sub-sectors were already recorded as direct employment of other sub-sectors. In cases of such double counting, an adjustment was made.

3 Conclusions

For the rail sector as a whole, the picture that emerges is one of a high-employment and heterogeneous sector. With its directly and indirectly related jobs, the German rail sector secures purchasing power and prosperity. It also plays an essential role for Germany as a business location and for people's mobility. Against the backdrop of the German government's climate targets, it can be assumed that the importance of the rail sector will increase even further in the future.

The majority of companies have a positive outlook for the future within a time horizon of ten years and expect both higher transport volumes by rail and higher employment in the rail sector. Meeting this anticipated demand for qualified specialists will pose challenges for the industry against the backdrop of an already existing shortage of skilled workers and strong cohorts of employees over the age of 55, who account for one-fifth to one-quarter of the workforce in all clusters and will retire in the foreseeable future.

Against this backdrop, it is not surprising that the majority of companies responded to the Corona pandemic primarily with short-time work and a reduction in temporary staffing, and only a small minority made compulsory redundancies or resorted to early retirement. The majority of companies have endeavored to retain their core workforce. However, the pandemic is initially a setback, which has sharply shifted the focus in many companies to short-term management of the impact of the pandemic. Also, the hiring freeze taken by 18 percent of companies and the vocational training freeze imposed by 5 percent of companies represents at least a delay in securing the employment needed to stem the expected growth.

An important element for securing the future will be the education, training and continuing education of qualified specialists. Looking at the current structure of the workforce and their vocational qualifications, this explicitly refers not only to employees with academic degrees, but also in particular to employees with recognized professional qualifications, for example in technical fields and master craftsmen / technicians. The change in the world of work, for example through digitalization and automation, also offers further challenges that can only be met through education, training and continuing education. In order to better understand the offerings, demand and possible deficits in the area of academic training and further and continuing education and to be able to derive recommendations for action on this basis, the German Centre for Rail Traffic Research (DZSF) at the Federal Railway Authority has commissioned two research projects "Analysis of university education in the rail transport sector" and "Analysis of further and continuing education and training opportunities in the rail transport sector", which are expected to deliver research results by the end of 2021.

The study further revealed that combined transport can be one of the growth drivers for rail transport, but that the sector is characterized by a complex value chain. Further research activities in this area could therefore provide more transparency on the economic activity and needs of this sector, for example with regard to framework conditions, and thus support the federal and state governments in rail policy and infrastructure planning.

In addition to being used within the framework of the Rail Master Plan by the Zukunftsbündnis Schiene, the present study also offers the possibility of carrying out comparisons based on the same calculation method, e.g., with the rail sectors in other European countries. Such an analysis could make a contribution to the desired stronger interlinking of the rail sector at the European level.

4 List of figures and tables

4.1 List of figures

4.2 List of tables

5 Appendix

5.1 Methodology for assessing the direct employment effect

The study used a mix of methods including primary and secondary research and a combination of top-down and bottom-up approaches to capture the employment impact at the sub-sector level. The combination of different sources and methods including primary data research, as well as the triangulation of all data obtained, provides the best basis for collecting information on specific market segments that are not captured at the appropriate level of detail in statistics. The focus of the data collection was on quantitative data. Expert interviews were additionally used for validation and to gain further insights.

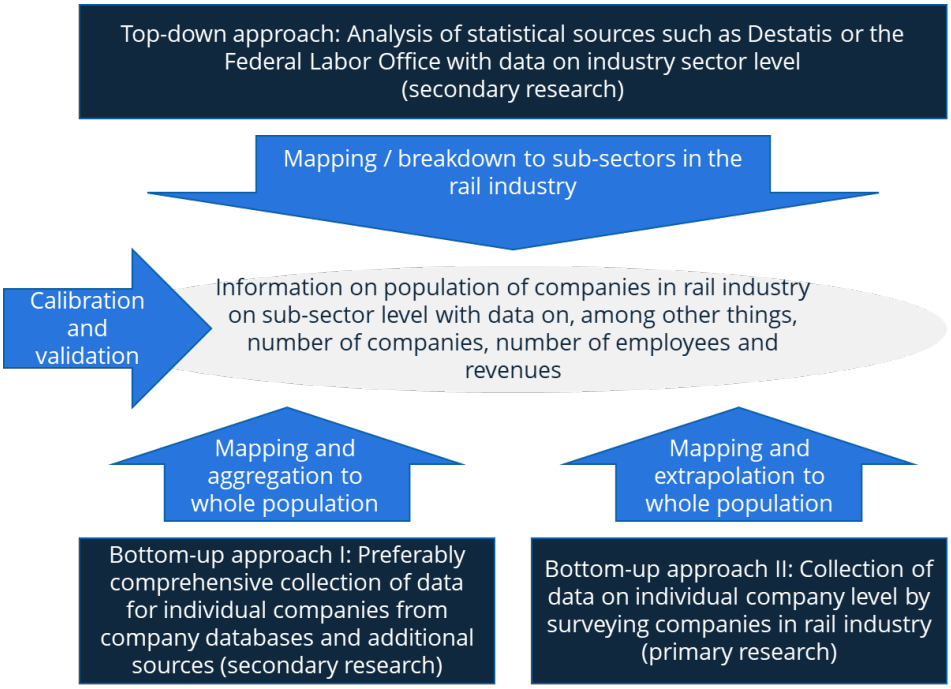

Figure 10: Schematic representation of the project approach for calculating the direct employment impact of the rail sector

As part of the bottom-up approach, the most complete data possible, such as revenues or employee numbers at the individual company level, was collected for all relevant companies in the rail sector on the basis of company databases and other secondary sources (bottom-up approach I). In sub-sectors where it was not possible to obtain nearly complete data on all relevant companies, an additional extrapolation was made to calculate the employment effect. This was based on available information on some of the companies and suitable extrapolation factors. In addition, a comparison was made with more highly aggregated secondary statistics.

The top-down approach involved the detailed analysis of available statistical sources. This was done at the highest possible level of detail including a breakdown and allocation of data to sub-sectors in the rail sector and, where relevant, to sectors outside the rail sector.

The core element of the chosen project approach for determining the direct employment impact was a survey of representatives of companies in the rail sector (bottom-up approach II). The combination of this primary research with the analysis of secondary sources within the framework of the top-down and bottom-up analysis enabled all data obtained to be calibrated and validated, thus providing a very good data basis for the calculation of the direct employment effect.

The construction of the data set within the framework of the bottom-up approach I, was carried out in two steps. In the first step, the companies that fall into one or more relevant sub-sectors were recorded as comprehensively as possible. In the second step, the data framework of companies and institutions was complemented with data from various sources that carry data on companies.

For the first step, as many sources as possible were initially used without any particular focus. In this approach, companies were covered at the smallest possible level, for example through different subsidiaries and not through the aggregate of a parent company.

The following sources were used to create the dataset that served as the basis for the survey and calculations:

- Official, or public, lists relating to regulated aspects of the rail industry
- Company databases (based on commercial register data, among other things)
- Member lists of relevant associations and clubs
- Exhibitor lists from relevant trade fairs
- Industry portals on the internet
- Targeted web search for relevant companies per sub-sector
- Job advertisement analysis
- Expert interviews
- Geoinformation systems (e.g., railway.tools of DB Netz AG with an overview of loading points and container terminals)

In the second step, the data set was populated. For this purpose, the following data was collected in full as far as possible:

- Total number of employees of the company / institution / organization
- Number of employees in FTE
- Revenues
- Shares of employees and revenues attributable to the rail sector

If, in addition to these variables, data was already available in one of the sources, these were taken. Furthermore, data from the company database Orbis, from the data provider Bureau van Dijk was added to the data set. In addition, gaps were filled via manual searches and extrapolation procedures.

In total, the approaches described above identified more than 8,700 companies with a potential connection to the rail sector. In a next step, this list was adjusted for duplicated companies and companies that do not have any relevant activities in the rail sector. In the process of cleaning up duplicates, parent-subsidiary relationships of companies were also taken into account, thus ensuring that both mothers and daughters were not included in the data set in parallel. After this adjustment, a good 2,200 companies with relevant activities remained in the data set.

The next step was to allocate the employees of these companies to the sub-sectors analysed and to activities outside the rail sector. For 219 companies that participated in the survey, the data collected in this way on the distribution of employees across the sub-sectors was used directly. A further 179 companies were analysed individually to estimate a distribution of employees across the sub-sectors, for example on the basis of the company's own website or data from its annual report. The remaining 1,817 companies analysed were assigned to archetypes based on a similarity analysis using various criteria such as membership of associations. This assignment to archetypes was also carried out for the companies for which survey results were available or which were analysed individually. For each archetype, a distribution of employment across sub-sectors was then estimated. This estimate was generally based on the distribution of employment for a single typical company or the average of the distribution of employees across sub-sectors for several companies within the archetype for which survey results were available or which were analysed individually. In cases where no reference companies were available within an archetype based on the survey or individual analysis, the distribution across sub-sectors was based on further individual analysis or expert judgment.

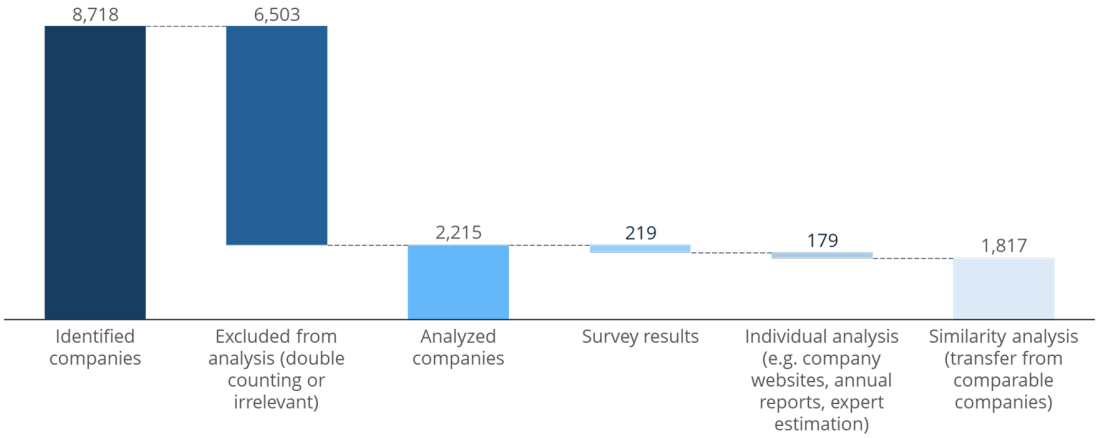

Figure 11: Number of companies analysed by methodology

The direct employment impact of each sub-sector was therefore determined from a combination of survey results, individual analyses, and similarity analyses for identified companies. Since some sub-sectors exhibit a high degree of fragmentation or greater intransparency regarding active companies and a nearly complete coverage was therefore not possible for these sub-sectors, additional top-down estimates for the employment impact were made for these sectors. For this purpose, expert interviews were conducted, analysed and compared with data (if available) from secondary statistics.

The employment impact of the following sub-sectors was determined primarily based on a top-down estimate:

- Factory and connecting railroads
- Siding owners
- Railway station trade
- Personal and object protection as well as track marshals
- Cleaning companies

For the following sub-sectors, the employment impact of the long tail of unidentified companies was estimated to complement the bottom-up analysis of identified companies:

- Rail forwarders
- Consulting companies
- IT service providers

In principle, the employment effects determined for all sub-sectors were compared and validated using secondary statistics and studies, where available.

The four methodologies and the proportion of direct employment impact was determined using the methodologies described below. The order presented corresponds to the prioritization of the results of the respective methodologies.

1. Direct results of the **company survey**

   The results of the market research were adopted directly at company level as the highest possible validity and reliability of the data was assumed here. This includes both the number of FTEs and the percentage allocation to corresponding sub-sectors. In terms of the total direct employment impact in the rail sector, 58 percent of employment was derived from the company survey.

2. **Individual analysis of** the company

   Manual research was conducted for relevant individual companies in the rail sector that were not covered by the company survey. These findings were based on several publicly available sources, such as annual reports or detailed analyses of company websites. In addition, expert assessments of individual companies from previously conducted interviews were also included when available. Overall, 10 percent of the total direct employment impact is based on the individual analysis of companies.

3. Analysis of **archetypes** within the framework of a similarity analysis

   The archetyping of the individual companies was based on criteria such as memberships in associations or classification of the services offered in industry portals. For each archetype, a percentage distribution of employment was made across the analysed sub-sectors or activities outside the rail sector. The percentage distribution for the archetype was then applied to all companies within an archetype for which no direct results were available from the company survey or based on an individual analysis. Overall, 19 percent of the direct employment impact in the rail sector was identified through the similarity analysis using archetypes.

4. **Top-down analysis**

   For some sub-sectors, top-down estimates were used in addition to or as a substitute for the bottom-up figures. These were derived from information provided in expert interviews or from the project team's own research. 13 percent of the direct employment impact in the rail sector is based on top-down analyses.

5.2 Methodology for assessing the indirect employment effect

The rail sector - like all sectors of the economy - absorbs resources from upstream sectors. The employment generated by absorption of goods and services in upstream sectors is referred to as indirect employment.

Input-output analysis (IO analysis) is an established method for estimating value added in the intermediate input chain. The current input-output table of the Federal Statistical Office for Germany refers to the year 2019 and differentiates 72 sectors. The 30 rail sub-sectors, that were analysed for the calculation of rail-dependent direct employment, were assigned to one of the original IO sectors each.

The number of resulting employees, due to the direct purchase of intermediate inputs, was calculated based on gross wages, salaries, and production values included in the IO table and based on average gross wages customary in the sector. This effect is referred to as the first-round effect.

Due to the objective of this study to capture employment in the rail sector comprehensively, there are strong cross-relationships between the sectors in the purchase of intermediate inputs. Regarding the cross-relationships, it is important to note that the indirect employment effect of intermediate consumption in one sub-sector may already be recorded as a direct employment effect in another sub-sector. In these cases, double counting was avoided. For example, the investment of a railway undertaking (RU) in a rail vehicle causes an indirect employment effect. However, employment by rail vehicle manufacturers is also already captured as direct employment in this study.

Starting from the first-round effect, further effects are triggered across the economy via the entire value chain of the various economic sectors. The rationale is based on the fact that sectors that provide intermediate inputs to the rail sector themselves also demand intermediate inputs from other sectors of the economy. As explained earlier, the rail sector demands intermediate inputs, for example, metal products. The triggered effects on the metal products manufacturing sector are captured as first round effects and have the effect of increasing output. However, these sectors require intermediate goods from other companies, which in turn purchase intermediate goods from other upstream sectors for their production. This effect on production and employment, which arises in this way, takes place in the entire value chain, and is therefore referred to as the value chain effect.