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Item 10 of the provisional agenda
Productivity in Rail Transport

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Note by the secretariat

I. Mandate

1. At its sixty-fifth session, the Working Party on Rail Transport (SC.2) asked the secretariat to prepare an update of the summary document on productivity in rail transport for its sixty-fifth session on the basis of information received from international sources and collected from member countries. This document is submitted in compliance with that mandate (ECE/TRANS/SC.2/216, paras. 29–30).

II. Rail productivity Indicators

2. In order to have an appropriate basis for drawing certain conclusions from productivity indexes, the Working Party on Rail Transport, at its fifty-first session in 1997 (TRANS/SC.2/188, paras. 17–18), underlined the importance of social, technical, economic and political frameworks for rail productivity. At its next session, the Working Party considered the data on rail productivity provided by the Organization for Cooperation between Railways (OSJD) and the International Union of Railways (UIC). Commenting on the differences in the value of productivity indicators between countries, it reiterated its observation that the technical, economic, political, geographic, etc. framework of each country was reflected, to a considerable extent, in productivity measurements. The Working Party underlined the fact that the principal difficulty in such comparisons was ensuring one was comparing like with like.

3. The rail productivity indicators adopted by the Working Party in 2000 (TRANS/SC.2/194, para. 23) are as follows:

Quantitative Rail Productivity Indicators

	Rail productivity indicator	*Measurement*	
A	Labour productivity (high-speed – conventional rail)		
	(1)	employees/km of network in use	
	(2)	net tonne-km/employee	passenger-km/ employee
B	Productivity of freight transport		
	(1) per km	gross tonne-km/km of network	net tonne-km/ km of network
	(2) per employee	gross tonne-km/employee	net tonne-km/ employee
C	Productivity of passenger transport (high-speed – conventional rail)		
	(1) per km	passenger-km/km of network	
	(2) per employee	passenger-km/employee	
D	Productivity of traffic (high-speed – conventional rail)	net tonne-km/km of network	passenger-km/ km of network
E	Productivity of locomotives (high-speed – conventional rail)	gross tonne-km/locomotive	
F	Productivity of wagons	net tonne-km/wagon	
G	Productivity of lines (where necessary only on railway lines to be determined)	passenger train-km/km of network	freight train-km/ km of network
H	Energy consumption (for traction power)	MJ/1000 gross tonne-km	

4. At its fifty-fourth session in 2000 (TRANS/SC.2/194), the Working Party again examined the productivity figures provided by OSJD, UIC and Trans-European Railway (TER) Project, and agreed that the indicators available should be completed by qualitative indicators. It also asked the secretariat to prepare a proposal in this sense, together with the TER project Central Office and in cooperation with the OSJD and UIC and to present it at its session in 2002 together with productivity figures from all UNECE member countries.

5. Authors note that railways are multi-product enterprises and their outputs have a spatial dimension as well as quality attributes. A number of methodologies have been used to assess the productivity performance of railways. Different methodologies, along with data and computational differences, lead to different empirical results and interpretations. One of the main objectives of productivity measurement is to make inferences about the efficiency of a firm, an organization, or industry. However, productivity variation can arise from different sources: differences in efficiency, economies of scale, differences in network characteristics, and other exogenous factors that affect performance (for example, average length of haul, composition of traffic, market size, quality of service, weather, or terrain conditions) and/or technological changes. Therefore, to make inferences about productive

efficiency, one must remove the effect on productivity caused by the differences in operating environment and other exogenous factors.

6. As suggested in the Working Party's reports and elsewhere in literature, the search for quality indicators of productivity of railways should continue. Bearing in mind limitations intrinsic to various theoretical and practical approaches, quality indicators of productivity should supplement those as defined by the Working Party, and enhance the quality of international comparisons of railway productivity indicators.

7. In this connection, the following list represents an attempt to address the issue by experts participating at the Working Party, and suggest possible indicators that, in combination with the quantitative indicators as defined by the Working Party, may indeed bring comparison of individual railways' productivity closer to realistic and more reliable results.

Qualitative Rail Productivity Indicators

Indicator	*Measure*	*Best practice*
Efficient service delivery	Price (US$ per freight tonne-km)	< 2 ¢
	Price (US$ per passenger km)	
Service quality	Average train speed (km/h) (urban, local, intercity, etc.)	
	% of arrivals less than 15 minutes late	95 %
Safety	Train accidents (per million train-km)	
Accessibility	Network density (route km/km^2)	
	Freight ton km/US$ GDP (Purchasing Power Parity)	
	Rail share of rail + truck ton km	
	Rail passenger km as % of passenger km + tonne-km (%)	
Environment quality	KJ of energy per converted tonne-km	
Financial sustainability	% of costs covered from internal cash generation (Real return on total gross assets) (%)	> 100 (USA)
Capital	Track operated under slow orders on track and structures	
	• route km	
	• % total km	
	km travelled per available locomotive/day	
Management	Ratio of average passenger tariff to average freight tariff (based on US$ per km) (%)	> 2.0 (Europe)
	Locomotive availability (%)	90 (USA)
	Freight and passenger wagon availability (%)	> 90 (USA/Europe)

8. During its 2002 session, the Working Party (TRANS/SC.2/198, para. 13) asked member Governments to reply to a questionnaire containing a range of quality indicators of railway productivity for passenger and freight transport separately (on efficient service delivery, service quality, safety, accessibility, environmental quality, financial

sustainability, capital and management together with the best practices) as referred to in TRANS/SC.2/2002/15, section IV. Furthermore, Governments were requested to propose, for the Working Party's 2003 session, what other qualitative criteria could be considered in the future and how to further advance the work on this issue.

9. Following the decision of the Working Party at its fifty-sixth session (TRANS/SC.2/198, para. 13), the secretariat collected replies (TRANS/SC.2/2003/8) to a questionnaire containing a range of quality indicators of railway productivity for passenger and freight transport as referred to in document TRANS/SC.2/2002/15, section IV.

10. Since then and for the next five years until the 2008 session of the Working Party (ECE/TRANS/SC.2/2008/5), the UIC was producing and submitting to the Working Party for its consideration a report with the quantitative rail productivity indicators based on UIC's member's data. In addition, until the 2005 session (ECE/TRANS/SC.2/204, para. 28) Governments were submitting their data regarding the qualitative indicators of productivity in rail transport (TRANCS/SC.2/2005/12/Add.1 and Add.2).

11. In 2010 and 2011 the secretariat produced the quantitative rail productivity indicators with data provided by UIC.

III. Rail Productivity Indicators for 2012 (data of 2010)

12. The data submitted by UIC were incomplete for few countries.

13. Data on energy consumption (for traction power) have not been included in the table due to the lack of availability of relevant statistics in most countries.

14. The indicators are illustrated in the Annex to the present document in the form of a table and maps.

IV. Guidance by the Working Party

15. Considering:

(a) the importance of rail productivity indicators as tool for measuring and exchange best practices;

(b) the relevant decisions by the Working Party regarding the calculation and interpretation of these rail productivity indicators;

(c) the significance of both quantitative and qualitative rail productivity indicators;

(d) the data or part of the data missing for some countries which actually leads to miscalculations or misinterpretations;

(e) the secretariat suggests the preparation of a questionnaire for the above mentioned quantitative and qualitative rail productivity indicators, translated into three languages which is going to be distributed every year to the Governments in due time to secure the accuracy and completeness of data.

16. The Working Party may wish to consider the above proposal and may wish to provide guidance to the secretariat on further action in this field.

Annex

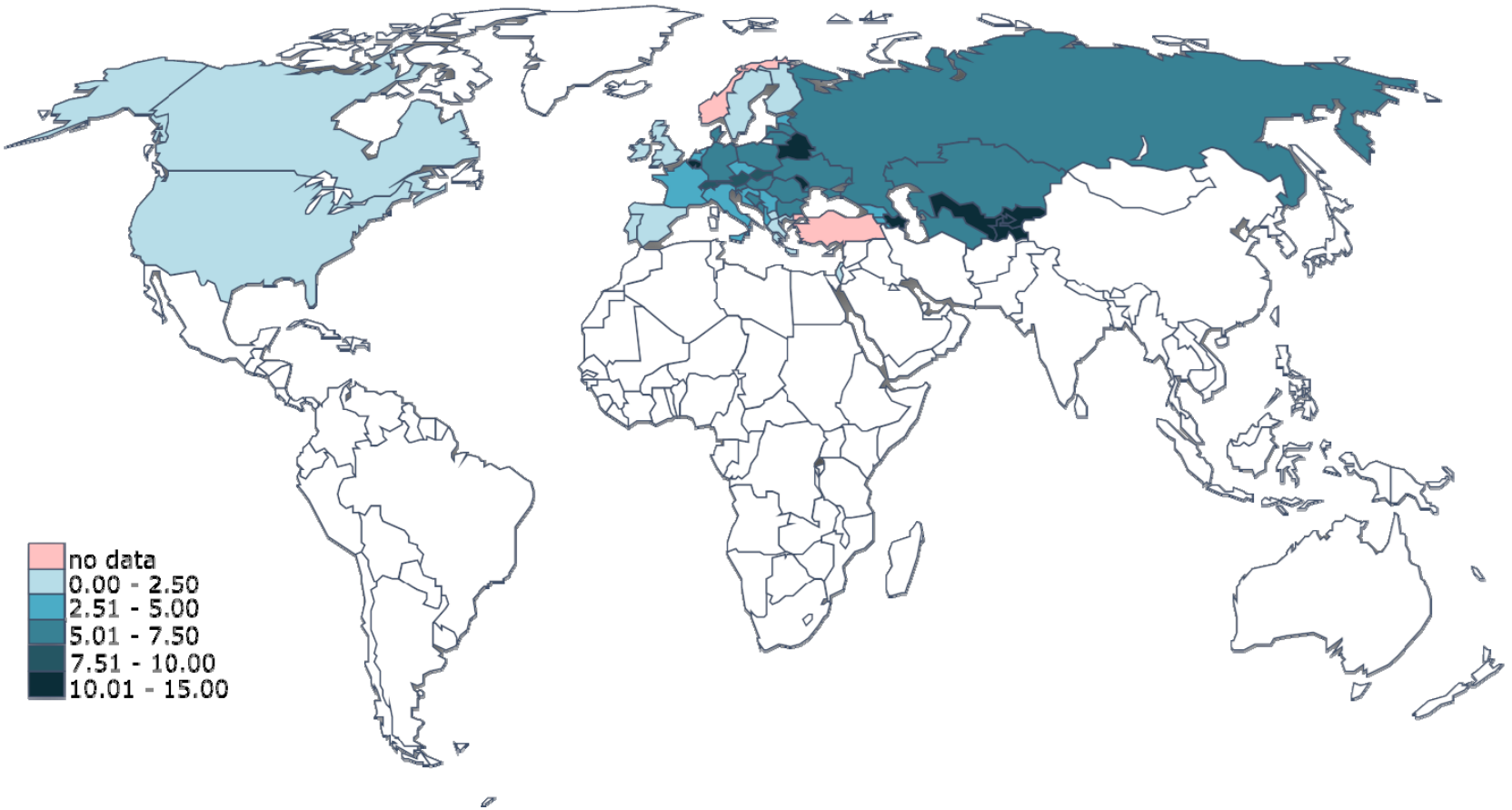
	Labour Productivity		*Productivity of freight transport*		*Productivity of Passenger transport*		*productivity of traffic*	*productivity of locomotives*	*productivity of wagons*	*productivity of lines*	*energy consumption*
	employees per km of line	*Pkm+Tkm per employee*	*tonne km per km of network*	*tonne km per employee*	*passenger km per km of network*	*passenger km per employee*	*net tonne km + passenger km per km of network*	*gross tonne km per locomotive*	*net tonne km per wagon*	*passenger train km + freight train km per km of network*	*MJ/1000 gross tonne-km*
	a1	*a2*	*b1*	*b2*	*c1*	*c2*	*d*	*e*	*f*	*g*	*h*
Albania	4.49	41.05	108.75	24.21	75.65	16.84	184.40	2,581.82	85.66	2.03	
Armenia	4.84	99.00	418.89	86.50	60.53	12.50	479.42	12,390.63	182.11	0.00	
Austria	9.01	735.79	4,584.04	508.79	2,045.25	227.00	6,629.29	68,051.39	807.52	29.78	
Azerbaijan	12.51	352.58	3,968.25	317.31	441.08	35.27	4,409.33	41,594.97	376.94	5.79	
Belarus	14.05	698.73	8,431.96	600.31	1,382.34	98.42	9,814.30	121,694.41	1,740.62	12.03	
Belgium	10.34	434.68	1,558.41	150.70	2,936.56	283.97	4,494.97	67,298.48	480.19	24.15	
Bosnia and Herzegovina	7.30	171.47	1,194.74	163.60	57.45	7.87	1,252.19	14,059.88	270.98	4.82	
Bulgaria	7.16	173.50	727.85	101.71	513.79	71.79	1,241.64	20,566.79	253.77	7.74	
Canada	0.70	8,789.68	6,142.60	8,753.37	25.48	36.32	6,168.09	198,563.50	4,768.11	1.99	
Croatia	4.78	335.38	961.79	201.38	639.97	134.00	1,601.76	32,588.00	392.27	9.47	
Czech Republic	4.81	406.02	1,259.08	262.00	692.12	144.02	1,951.20	26,212.59	434.82	15.69	
Denmark	5.16	673.18	0.00	0.00	3,474.89	673.18	3,474.89	0.00	0.00	34.79	
Estonia	2.54	3,251.00	7,946.63	3,127.00	315.12	124.00	8,261.75	190,066.67	2,114.27	8.59	
Finland	1.69	1,370.90	1,647.24	975.00	668.86	395.90	2,316.10	62,350.84	931.77	8.62	
France	2.60	693.50	382.69	147.07	1,421.87	546.43	1,804.56	54,451.78	902.27	7.58	
Georgia	4.47	983.29	3,977.01	889.71	418.26	93.57	4,395.27	0.00	477.57	0.00	
Germany	7.48	731.65	3,138.64	419.82	2,331.33	311.83	5,469.96	75,968.04	972.01	26.27	
Greece	1.57	134.50	210.82	134.50	0.00	0.00	210.82	0.00	170.36	0.00	
Hungary	5.13	160.78	109.74	21.39	715.21	139.40	824.94	26,186.82	8,697.92	13.88	

	Labour Productivity		*Productivity of freight transport*		*Productivity of Passenger transport*		*productivity of traffic*	*productivity of locomotives*	*productivity of wagons*	*productivity of lines*	*energy consumption*
	employees per km of line	*Pkm+Tkm per employee*	*tonne km per km of network*	*tonne km per employee*	*passenger km per km of network*	*passenger km per employee*	*net tonne km + passenger km per km of network*	*gross tonne km per locomotive*	*net tonne km per wagon*	*passenger train km + freight train km per km of network*	*MJ/1000 gross tonne-km*
	a1	*a2*	*b1*	*b2*	*c1*	*c2*	*d*	*e*	*f*	*g*	*h*
Ireland	2.08	442.25	47.94	23.00	873.89	419.25	921.83	0.00	183.27	8.82	
Israel	1.74	1,693.33	1,027.08	590.00	1,920.70	1,103.33	2,947.78	63,845.24	1,517.14	10.17	
Italy	4.73	749.72	1,139.69	240.93	2,406.81	508.79	3,546.50	593.38	676.77	17.28	
Kazakhstan	6.58	2,450.40	15,029.19	2,284.82	1,089.11	165.57	16,118.30	233,277.94	2,132.29	10.70	
Kyrgyzstan	11.99	167.40	1,769.78	147.60	237.41	19.80	2,007.19	33,133.33	414.84	2.57	
Latvia	6.33	1,104.83	6,945.18	1,097.92	43.75	6.92	6,988.93	118,882.65	2,182.01	4.32	
Lithuania	5.66	1,393.70	7,601.02	1,343.10	286.36	50.60	7,887.38	97,794.01	1,453.89	8.13	
Luxembourg	14.55	134.00	687.27	47.25	1,261.82	86.75	1,949.09	12,817.31	48.52	26.87	
Moldova	11.24	110.69	879.00	78.23	364.74	32.46	1,243.73	20,138.16	128.43	2.82	
Montenegro	7.23	0.00	0.00	0.00	0.00	0.00	0.00	9,181.82	0.00	1.49	
Netherlands	4.85	1,096.57	0.00	0.00	5,319.47	1,096.57	5,319.47	0.00	0.00	39.26	
Norway	0.00	466.10	0.00	0.00	0.00	466.10	0.00	0.00	0.00	0.00	
Poland	5.43	467.68	1,742.31	320.81	797.63	146.87	2,539.95	29,864.94	503.69	8.99	
Portugal	2.46	824.86	723.43	293.71	1,308.23	531.14	2,031.67	10,489.80	643.71	13.18	
Romania	5.14	254.57	821.66	159.84	486.96	94.73	1,308.62	19,151.58	121.96	7.40	
Russian Federation	5.86	4,300.67	23,581.44	4,022.62	1,630.02	278.06	25,211.46	0.00	9,468.50	16.81	
Serbia	4.99	199.63	848.25	170.05	147.55	29.58	995.80	26,066.67	380.52	5.43	
Slovakia	8.83	311.25	2,117.34	239.66	632.52	71.59	2,749.86	0.00	452.07	12.02	
Slovenia	6.11	546.13	2,673.45	437.73	662.05	108.40	3,335.50	187,316.46	1,022.42	15.81	
Spain	2.07	925.96	504.73	243.63	1,413.56	682.33	1,918.29	110,334.46	547.19	13.10	
Sweden	0.76	929.47	0.00	0.00	709.45	929.47	709.45	44,259.26	0.00	5.05	
Switzerland	8.54	1,031.41	3,669.47	429.87	5,134.90	601.54	8,804.37	8,604.59	1,490.90	52.59	
Tajikistan	12.99	105.13	1,311.69	101.00	53.57	4.13	1,365.26	25,451.61	299.48	1.52	

	Labour Productivity		*Productivity of freight transport*		*Productivity of Passenger transport*		*productivity of traffic*	*productivity of locomotives*	*productivity of wagons*	*productivity of lines*	*energy consumption*
	employees per km of line	*Pkm+Tkm per employee*	*tonne km per km of network*	*tonne km per employee*	*passenger km per km of network*	*passenger km per employee*	*net tonne km + passenger km per km of network*	*gross tonne km per locomotive*	*net tonne km per wagon*	*passenger train km + freight train km per km of network*	*MJ/1000 gross tonne-km*
	a1	*a2*	*b1*	*b2*	*c1*	*c2*	*d*	*e*	*f*	*g*	*h*
The former Yugoslavia republic of Macedonia	2.15	453.33	751.07	350.00	221.75	103.33	972.82	23,396.23	458.92	3.99	
Turkey	0.00	0.00	1,139.46	0.00	572.34	0.00	1,711.80	40,615.13	615.09	4.07	
Turkmenistan	6.10	726.47	3,849.76	631.16	581.38	95.32	4,431.14	0.00	848.99	0.00	
Ukraine	5.44	2,273.99	10,047.96	1,848.23	2,314.67	425.76	12,362.64	102,758.24	1,184.59	20.42	
United Kingdom	2.44	1,360.20	0.00	0.00	3,313.67	1,360.20	3,313.67	0.00	0.00	31.79	
USA	0.76	14,408.47	10,930.05	14,353.13	42.14	55.34	10,972.19	180,792.73	5,931.90	3.66	
Uzbekistan	13.00	457.95	5,267.61	405.13	686.76	52.82	5,954.37	141,473.86	924.41	5.15	

Figure 1

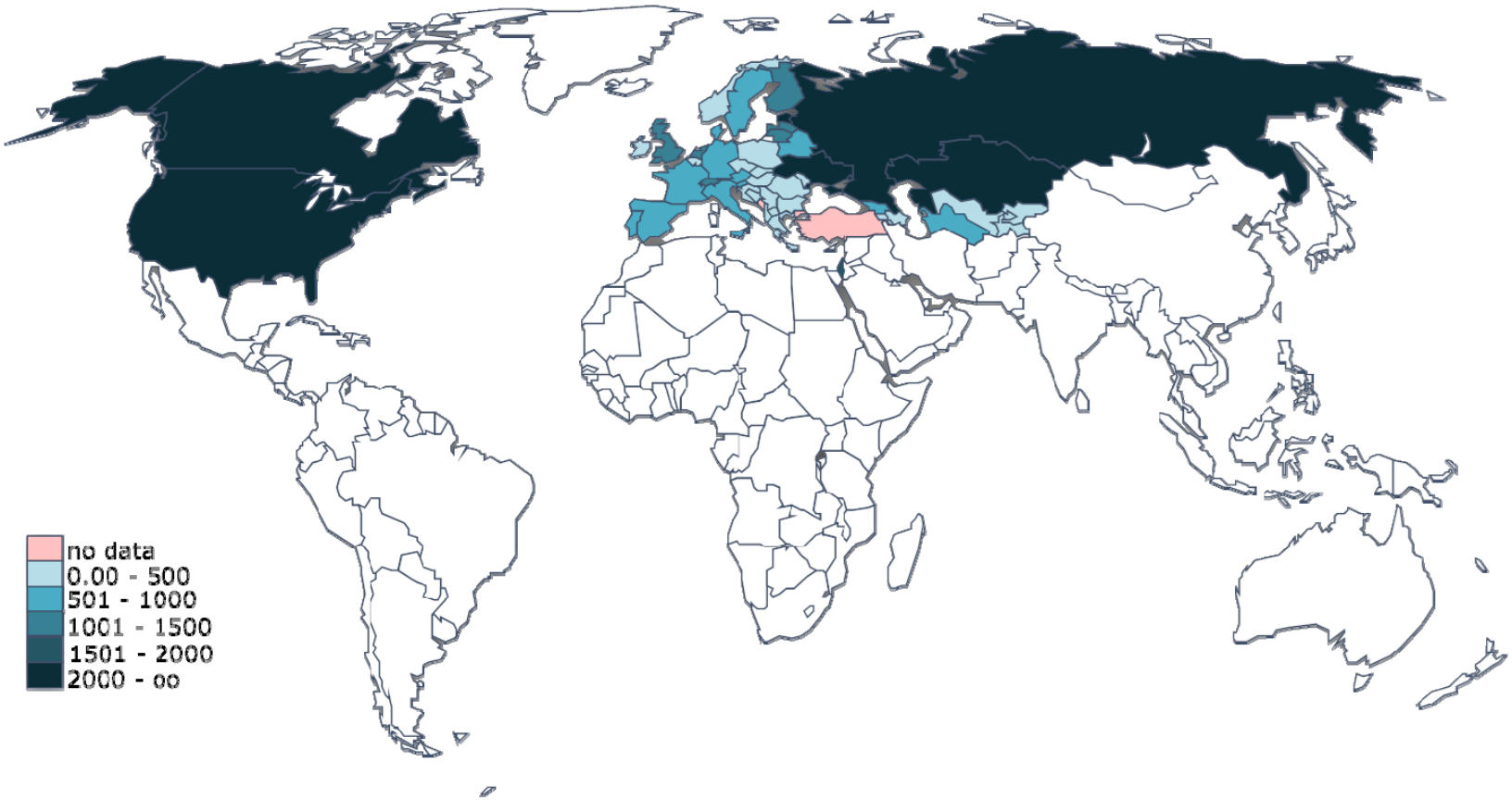
A.1 Labour productivity (high-speed – conventional rail): Employees/km of network in use



Source: UIC and UNECE calculations

Figure 2

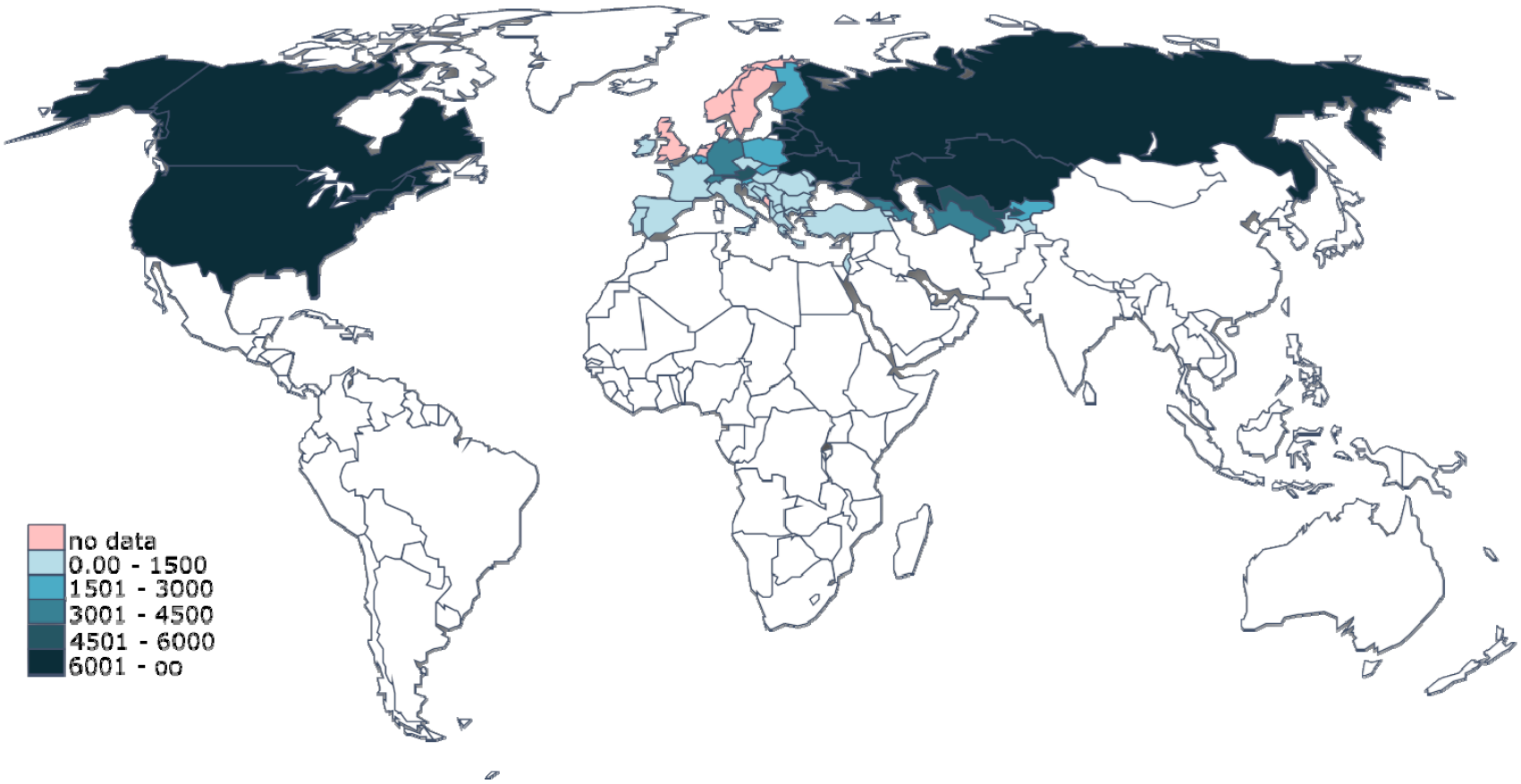
A.2 Labour productivity (high-speed–conventional rail): Passenger km (Pkm) + Net tonne-km (Tkm) /Employee



Source: UIC and UNECE calculations

Figure 3

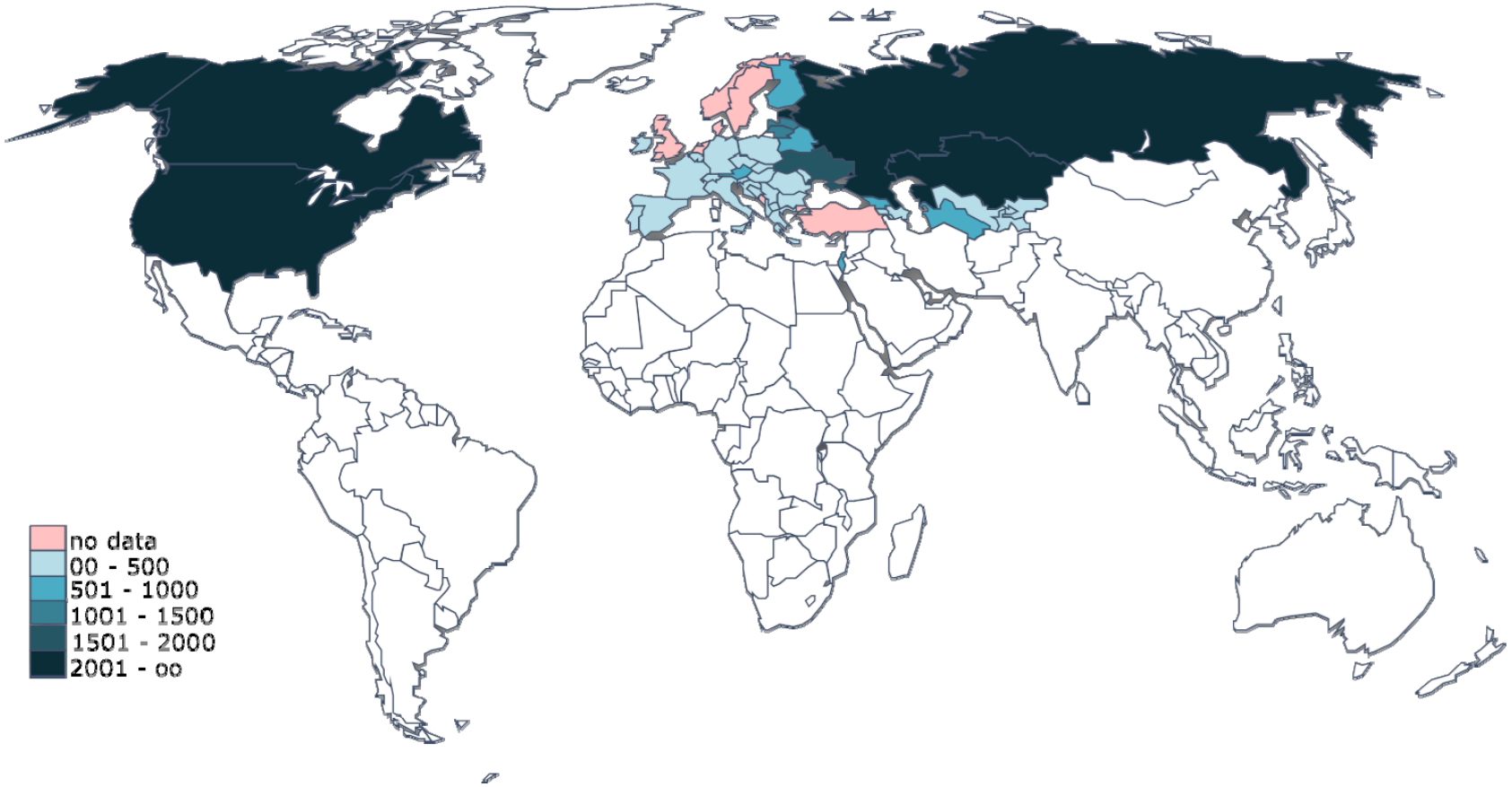
B.1 Productivity of freight transport per km: Gross tonne-km/km of network



Source: UIC and UNECE calculations

Figure 4

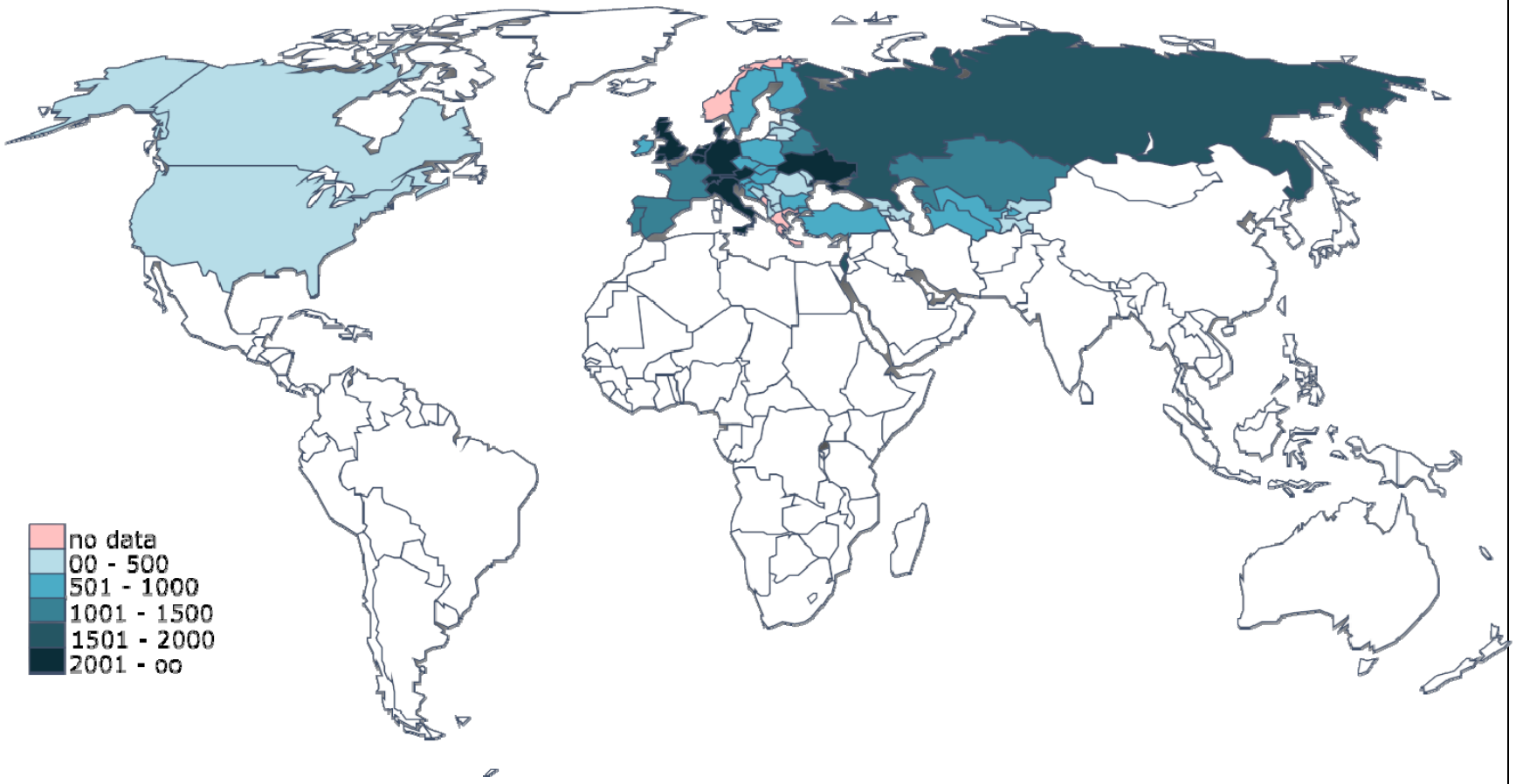
B.2 Productivity of freight transport per employee: Gross tonne-km/Employee



Source: UIC and UNECE calculations

Figure 5

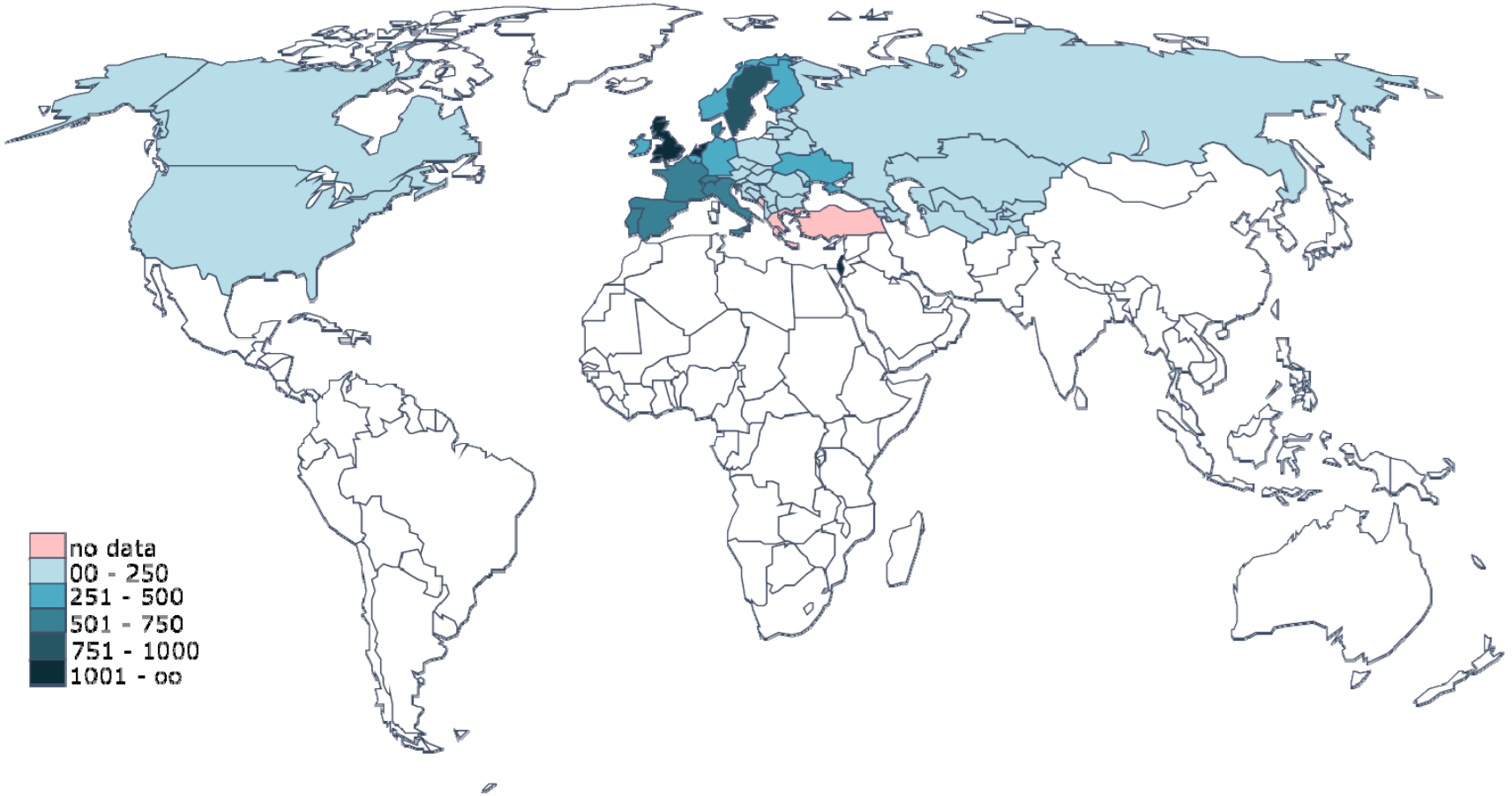
C.1 Productivity of passenger transport (high-speed – conventional rail) per km: Passenger-km/km of network



Source: UIC and UNECE calculations

Figure 6

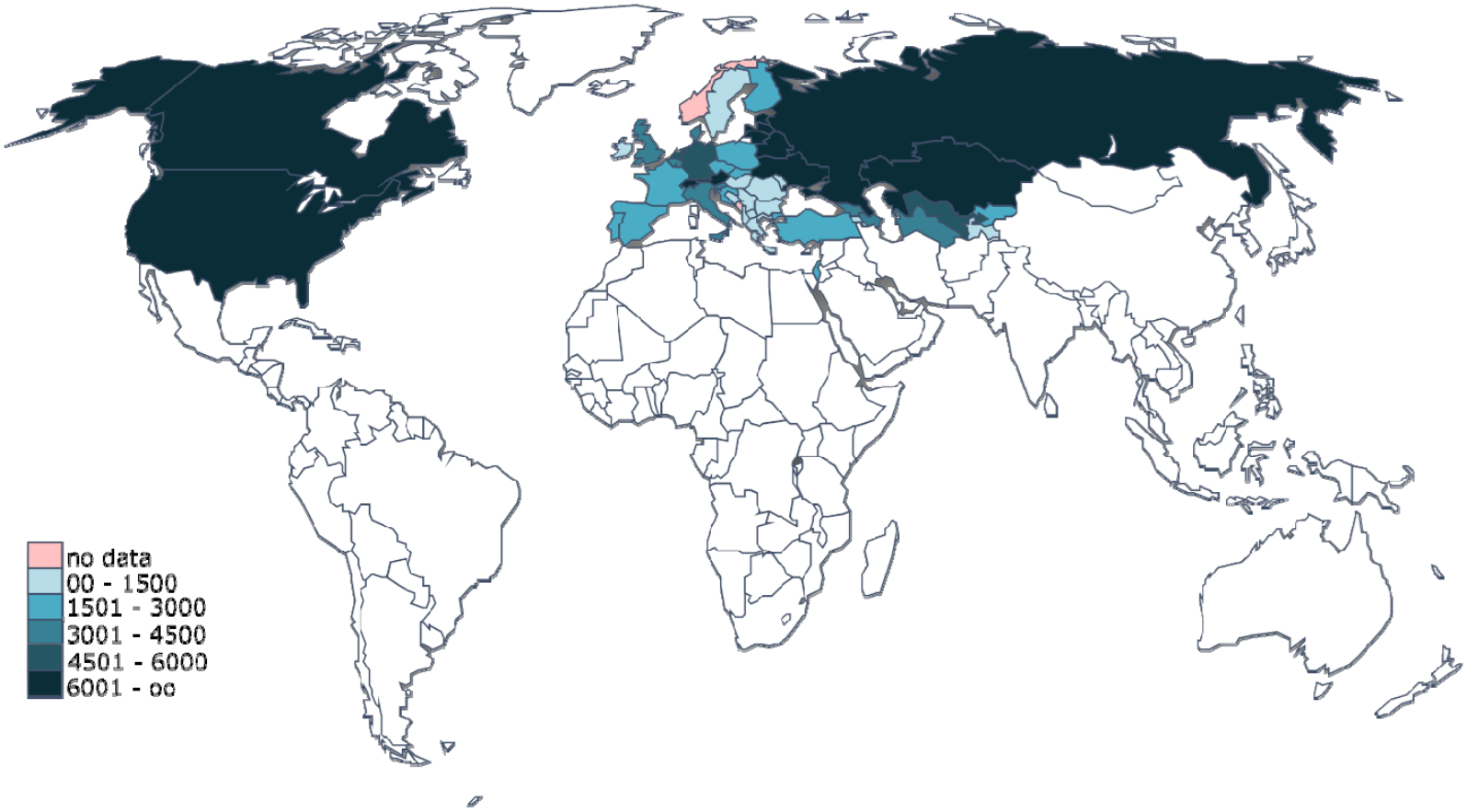
C.2 Productivity of passenger transport (high-speed – conventional rail) per employee: Passenger-km/Employee



Source: UIC and UNECE calculations

Figure 7

D. Productivity of traffic (high-speed-conventional rail): Net tonne-km + passenger km per km of network



Source: UIC and UNECE calculations