SAFETY AND SUSTAINABILITY

Tracking Availability of SDG 9.1 Indicators Regarding Transport Infrastructure Using the Example of G20 Member Countries

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ABSTRACT

The increased interest in implementation of the sustainable development agenda requires an objective assessment of the success of progress towards the set sustainable development goals and objectives.

The objective of the study described in the article is to consider the availability of transport indicators for SDG 9.1 («Develop high-quality, reliable, sustainable and resilient infrastructure, including regional and cross-border infrastructure, in order to support economic development and human well-being, with particular attention to ensuring affordable and equitable access for all») on the example of G20 countries, as well as to assess the completeness of the data provided by the countries. The information and empirical base of the study is based on data from the United Nations Economic Commission for Europe and Federal State Statistics Service of the Russian Federation. The study used general scientific methods of analysis, synthesis, and classification.

The result of data processing is an assessment of data availability and calculation of the data completeness index for G20 countries. The authors proposed additions to the monitored indicators in terms of the volume of passenger and cargo transportation by modes of transport, and also substantiated the need to introduce a new indicator «volume of investment in infrastructure by mode of transport».

Keywords: SDG, sustainable development, infrastructure, transport infrastructure, volume of passenger transportation, volume of cargo transportation, volume of investment in infrastructure.

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Текст статьи на русском языке публикуется в первой части данного выпуска.

INTRODUCTION

The implementation of the 2030 Agenda for Sustainable Development with updated goals started on January 1, 2016[1]. Transport plays an important role in its implementation. There are a number of sustainable development goals (hereinafter referred to as SDG) that are directly related to transport, including SDG 9 on sustainable infrastructure and SDG 11 on sustainable cities. In addition, sustainable transport makes it possible to realise almost all of the SDG through the provision of connectivity and accessibility of territories.

Goal 9 «Build resilient infrastructure, promote inclusive and sustainable industrialization and innovation» includes eight targets and 12 indicators. The United Nations Economic Commission for Europe (*hereinafter –* UNECE) offers a special section on its website for free user access to data on implementation of SDG [1]. SDG 9 tracks 10 out of 12 indicators across 56 countries. No data are available for indicators 9.1.1 «Percentage of rural population living less than 2 km from a road that is passable all year round» and 9.a.1 «Total official international support for infrastructure». An analysis of the description of the metadata shows that the units of measurement and classification according to these indicators are also missing [2].

Target 9.1 «Develop quality, reliable, sustainable and resilient infrastructure, including regional and cross-border infrastructure, to support economic development and human well-being, with particular attention to affordable and equitable access for all» and, accordingly, indicators 9.1.1 «Percentage of the rural population living less than 2 km from a road that is passable all year round» and 9.1.2 «Passenger and freight volume, by mode of transport» refer to transport in SDG 9.

To improve understanding and knowledge of transport-related SDG, the UNECE Sustainable Transport Division held three workshops in 2017. These workshops allowed the participants to link the achievement of SDG with the national transport policy, to obtain information on statistical tools for accurately measuring and monitoring the implementation of SDG. Global conferences on sustainable transport were held in 2016 and 2021, thematic

conferences and workshops are also held on regular basis.

Consistent measurement, monitoring of goals, objectives and indicators are among the main tasks in implementation of the sustainable development agenda. Within the framework of SDG in transport, the world academic community is studying rural transport and approaches to measuring accessibility of transport in rural areas (based on data from geographic information systems), methods for calculating indicators at the country and city levels, accessibility of urban transport infrastructure, and quantifying the environmental and social impacts of SDG 9.1, sustainability of port infrastructure and other topical issues [3–12].

The *objective* of the study is to consider availability of transport indicators 9.1.1. and 9.1.2. within SDG 9 on the example of G20 countries, as well as to assess the completeness of data provided by countries.

The information and empirical base of the report is represented by the UNECE and Rosstat [Russian State Federal Statistics Service] data. Research *method* is focused on processing empirical data, comparative analysis and classification.

RESULTS
Analysis of Measured Indicators

SDG 9 in terms of transport tracks two indicators: 9.1.1 «Percentage of the rural population living within 2 km of a year-round road» and 9.1.2 «Passenger and freight volume, by mode of transport». The UNECE database does not contain information on indicator 9.1.1. Indicator 9.1.2 is tracked for each mode of transport separately. As of October 2022, the following data is available:

(a) Cargo transportation volume (railway transport).

(b) Cargo transportation volume (road transport).

(c) Cargo transportation volume (inland water transport).

(d) Passenger transportation volume (passenger cars).

(e) Passenger transportation volume (railway transport).

At the same time, the Glossary for transport statistics, compiled as a result of cooperation between the UNECE, the International Transport Forum and Eurostat, contains definitions of many

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indicators in the sections of railway transport, road transport, inland water transport, maritime transport, air transport [14]. An analysis of the metadata description shows that the main data providers are the International Civil Aviation Organization (ICAO); International Transport Forum (ITF); United Nations Economic Commission for Europe (UNECE); United Nations Conference on Trade and Development (UNCTAD) [2]. For the purposes of monitoring the volume of passenger and cargo transportation, data on passenger-kilometres should be allocated between air, road (disaggregated by cars, buses, and motorcycles) and railway transport, and data on tonne-kilometres should be allocated between air, road, rail and inland water transport.

According to the 2017 High-level Political Forum on sustainable development Thematic Review, investments in infrastructure and technology that simultaneously reduce time, labour costs, reduce carbon emissions and create jobs are key to achieve SDG 9 [15]. We do not consider other types of infrastructure in our study, but it is worth noting that investments in infrastructure in general, and in transport in particular, have the potential to support economic growth. There are significant differences in access to infrastructure, for example, about a third of the world's population does not have year-round roads. Most of the discussions and initiatives are focused on large-scale infrastructure. However, limited attention is paid to last mile infrastructure requirements, such as reducing urban-rural disparities in terms of quality and access, and supporting local food systems (as opposed to strengthening the infrastructural foundations of export-oriented food chains or large urban markets). This bias is also confirmed by the lack of data for indicator 9.1.1 «Proportion of the rural population living within 2 km of a year-round road».

In the scientific community, the issue of measuring indicator 9.1.1 has been studied for a long time. The 2 km accessibility indicator itself was adopted in SDG based on the Rural Access Index (RAI) developed in 2006 by the World Bank.

Eliminating infrastructure imbalances will require significant investment. According to the McKinsey Institute, the global infrastructure investment gap by 2035 worldwide is estimated at $5,5 trillion, excluding the additional investment needed to achieve the SDG [16]. In this regard, it is especially important to develop and implement financial instruments for managing and investing in infrastructure projects, as well as monitoring the effectiveness of their use. Particular attention needs to be paid to the sequencing of investments to make the best use of limited public resources and open up new opportunities for the private sector to participate in filling the gaps. The private sector, through well-structured private-public partnerships, can provide an important contribution to infrastructure financing. Ensuring that the public interest is protected while achieving development goals requires close attention. Efforts in this direction can be supported by the use of relevant standards, including standards for conducting a pre-project analysis of investment projects for transport infrastructure, conducting a post-project assessment of implemented infrastructure projects, as well as standards for a hierarchy of indicators of transport infrastructure by mode of transport.

Given the importance of tracking the volume of passenger and cargo transportation across all modes of transport, as well as the criticality of the issue of investment in infrastructure, we suggest considering the possibility to:

1. Add to indicators 9.1.2:
• Cargo transportation volume (sea transport).
• Cargo transportation volume (air transport).
• Passenger transportation volume (inland water transport).
• Passenger transportation volume (sea transport).
• Passenger transportation volume (air transport).
2. Introduce an additional indicator (for example, 9.1.3) «Volume of investment in infrastructure by mode of transport»:
• Volume of investment in infrastructure (railway transport).
• Volume of investment in infrastructure (road transport).
• Volume of investment in infrastructure (inland water transport).
• Volume of investment in infrastructure (sea transport).
• Volume of investment in infrastructure (air transport).

Determining the efficiency of using investments in transport infrastructure is a complex methodological task and can be further studied.

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Data Availability Analysis

The UNECE SDG indicators database contains data for 56 countries. There are no such G20 members in the list of 43 countries in the database as Argentina, Australia, Brazil, India, Indonesia, China, Mexico, Saudi Arabia, South Africa, South Korea, and Japan; for the rest of the countries, data are available in varying detail [1]. For Australia, information is available by mode of transport for cargo transportation for 2014–2016 and for passenger transportation for 1999–2016 to 2016 on a separate Australian Government's Reporting Platform on the SDG Indicators [17].

We analysed the availability of data for indicators 9.1.2 for 2016–2020 (data for 2021 and 2022 are not available) for 32 countries. Table 1 shows the availability and completeness of data on monitored indicators in the context of each country. An additional study of the data for the Russian Federation and Malta showed that there were no data for Malta initially (since 2000, when the collection began), for the Russian Federation there are data in varying completeness for the period from 2000 to 2013, since 2014 there are no data.

Based on available data, we calculated a data availability index for each country for SDG 9.1.2 indicators and grouped the results into five groups (Table 2).

Complete data is available for Croatia, the Czech Republic, Finland, France, Hungary; for Italy, there are no data on the volume of cargo transportation (inland water transport) for 2021. These countries are classified in Group 1. In group 2, all countries except Germany and Latvia have no data on the volume of passenger transportation (cars). For Latvia, there are no data on the volume of cargo transportation by inland water transport; however, based on the materials of the UNECE Committee on Inland Transport dated July 28, 2003, at the sixty-fifth session, the issue of the project «Transit route Daugava (Western Dvina)–Dnieper» connecting the Baltic and Black Seas was raised [18]. As of 2022, the project has not been initiated. This suggests that missing data should be replaced by zeros, which would allow Latvia to be moved to Group 1 with 100 % data provision. However, due to the fact that the basis for the analysis is statistical information from the UNECE databases, we do not consider it right to transfer the country to another group. It may be worth adding additional methodological clarifications to the description of metadata, on the subject of how to display data if they are not applicable to the country.

Let us dwell separately on the indicator concerning the volume of passenger transportation by cars (passenger transportation on the national territory by cars registered in the reporting country), measured in passenger-kilometres per car [1]. Of 32 countries, eight have partial and eight complete data, and information is missing for 16 countries. This significant lack of data may be due to the nature of data collection at the national level: data may either be incomplete or not available in countries' statistical systems.

Analysis of Data Availability for the Russian Federation

For the Russian Federation, there are no data in the UNECE database since 2014. At the same time, traffic data is regularly published by Rosstat. Thus, although data are available, they are either not updated (last data available on pages https://w3.unece.org/SDG/en/Indicator?id=89 et al. were as of 2013) or are not shown in the UNECE SDG that refers in turn to database of UNECE Transport Division Database. At the same time the UNECE page contains a link to national Web platform on data for SDGs, thet leads to relevant Rosstat page in English Росстата[2] [19].

Rosstat, on the basis of the Decree of the Government of the Russian Federation of June 6, 2017, No. 1170-r, is responsible for official statistical information on SDG indicators. The section «Sustainable Development Goals» on the website of Rosstat contains general information about SDG, a detailed list of indicators with the current status of their development, and metadata.

In terms of implementation and monitoring of SDG 9, nine indicators are available [20]:

1. Cargo turnover by mode of transport, billion t-km (all modes and separately for road, rail, air, sea, inland water transport and pipelines).

2. Passenger turnover by types of public transport, billion passenger-km (all modes and separately for rail, sea, inland water, air transport, as well as for transportation by buses, trams, trolleybuses, metro).

3. Density of public railways per $10\,000\text{ km}^2$ of territory, km.

[2] [Electronic resource]: https://eng.rosstat.gov.ru/sdg. Last accessed 13.03.2023.

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	9.1.2 – Freight volume by rail transport, tonne kilometres					9.1.2 – Freight volume by road transport, tonne kilometres				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Croatia	2160	2592	2743	2911	3279	11337	11833	12635	12477	12254
Czechia	15619	15843	16564	16180	15251	50315	44274	41073	39059	56090
Finland	9455	10362	11175	10270	10138	26852	27977	28413	28847	29705
France	34761	35655	34061	33671	31559	157894	170355	171495	173846	170015
Hungary	10528	11053	10584	10625	11595	40006	39687	37948	36951	32223
Italy	22394	22335	22070	21309	20750	112639	112949	124915	137986	133255
Germany	112553	119883	122728	122805	108405	315769	313143	316766	311869	304610
Lithuania	13790	15414	16885	16181	15865	30974	39099	43590	53117	55292
Austria	21361	22256	21996	21736	20498	18091	18400	18594	18905	18732
Netherlands	6641	6467	7026	7018	6665	67785	67532	68906	68336	67592
Poland	50650	54797	59388	54584	51096	290749	335220	315874	348952	354926
United Kingdom	17053	17167	17206	16872	15212	159555	158410	163764	165499	145520
Bulgaria	3434	3931	3824	3902	4503	35402	35185	27002	20614	32566
Latvia	15873	15014	17859	15019	7979	14227	14972	14997	14965	13705
Romania	13535	13782	13076	13312	12291	48175	54704	58761	61041	55026
Slovakia	9111	8486	8691	8480	7268	36106	35362	35590	33888	31591
Denmark	2574	2653	2594	2524	2450	15956	15515	14989	14991	14685
Sweden	21406	21838	23358	22717	22094	42685	41848	43474	42601	43183
Turkiye	11010	11851	13734	..	15571	253139	262739	..	..	272913
Portugal	2774	2751	2765	2478	2402	34684	34073	32676	31087	24402
Estonia	2340	2325	2595	2155	1729	6717	6189	5783	4794	4281
Slovenia	4360	5128	5151	5292	4726	18714	20814	22225	..	22662
Spain	10550	10418	10650	10710	8920	216993	231105	238991	249555	242265
Canada	395889	423664	448319	451277	420233	294716	299858	269285	..	..
Ireland	102	100	88	72	..	11564	11759	11537	12403	11383
Belgium	..	..	..	..	..	35579	34219	32684	34829	34506
Greece	254	358	408	490	..	20903	..	..	..	..
United States	2326216	2445138	..	..	..	..	..	..	..	..
Cyprus	..	..	..	..	..	703	828	892	858	709
Luxembourg	..	..	..	..	..	..	..	..	..	..
Malta	..	..	..	..	..	..	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..	..	..

Source: compiled by the authors based on UNECE data [1].

Table 1

on UNECE Website for SDG indicators 9.1.2

9.1.2 – Freight volume (Inland waterway transport), tonne-kilometres					9.1.2 – Passenger car, passenger kilometres (millions)					9.1.2 – Passenger rail, passenger kilometres (millions)				
2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
836	813	678	835	903	26181	26189	25594	25372	20215	836	745	756	734	449
36	25	23	32	18	72255	74327	77971	81179	68936	8843	9498	10286	10931	6665
103	120	120	122	127	57006	66607	66800	66800	64100	3868	4271	4535	4924	2820
8135	7311	7089	7855	6806	783085	789372	786793	779810	629846	91832	95024	91818	96540	56606
1976	1992	1608	2120	1998	57354	60645	63947	67034	63921	7653	7731	7770	7752	4854
67	61	74	69	..	704542	744919	722894	732429	488299	52178	53231	55493	56586	22269
54347	55518	46901	50919	46338	952332	922738	921900	899577	809319	94197	95530	98161	..	..
0	0	0	0	0	25854	31361	30119	..	..	280	315	354	359	237
1962	2022	1489	1715	1606	80444	81795	..	..	..	12578	12657	13205	13350	7417
49399	48998	47244	47581	45184	..	138700	..	..	..	18531	18438	18895	19353	9164
105	108	119	84	77	213318	..	..	..	..	19175	20318	21043	22055	12487
108	99	93	187	87	667526	..	..	..	..	68010	68912	69706	1978	25074
5477	5280	4858	5867	6256	..	..	..	..	..	1458	1438	1479	1524	1119
..	..	..	..	..	13899	14979	15257	15501	14775	584	596	624	643	413
13153	12517	12261	13957	13638	..	..	..	..	..	4988	5664	5577	5906	3720
903	933	778	937	834	..	..	..	..	..	3595	3873	3915	4093	2180
..	..	..	..	..	58781	59736	60417	..	58226	6119	6061	5939	5913	3755
..	..	..	..	79	..	..	..	..	..	12800	13331	13547	14617	8129
..	..	..	..	..	213853	..	229439	240517	215296	4325	4567	5560	14259	8297
..	..	..	..	..	..	..	..	..	..	4146	4391	4487	4964	2552
..	..	..	..	..	..	..	..	..	..	316	366	417	392	263
..	..	..	..	..	..	10213	..	..	..	680	650	656	698	397
..	..	..	..	..	..	..	..	..	..	26532	27381	28442	28847	12060
..	..	..	..	..	..	..	..	..	..	1409	1561	2055	1729	235
..	..	..	..	..	..	..	..	..	..	2173	2306	2598	2704	..
10331	11098	11357	7819	7388	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	1192	1112	1104	1253	640
445280	..	..	..	..	..	..	..	..	..	35828	33259	31963	32483	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	417	438	443	463	269
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

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Table 2

**Grouping countries based on data availability index
in UNECE database (data since 2016 and later)**

Group	Countries	Data availability index, %	Number of missing indicators
1	Croatia, Czech Republic, Finland, France, Hungary, Italy	96—100	0
2	Germany, Latvia, Austria, Netherlands, Poland, Great Britain, Bulgaria, Latvia, Romania, Slovakia	80—95	1
3	Denmark, Sweden, Turkey, Estonia, Slovenia, Spain, Portugal	60—79	2
4	Canada, Ireland, Belgium, Greece, USA, Cyprus, Luxembourg	20—59	3
5	Malta, Russian Federation	0	5

Source: compiled by the authors based on UNECE data [1].

4. Density of public roads with hard surface per 1 000 km^2 of territory, km.

5. Share of motor roads of regional significance that meet regulatory requirements, %.

6. Share of motor roads of regional or intermunicipal significance that meet regulatory requirements.

7. Total length of local roads.

8. Share of local roads that meet regulatory requirements.

9. Index of the quality of transport infrastructure as compared to the level of 2017.

Also, publication of data on one more indicator («Proportion of vehicles in urban agglomerations (buses, trams, trolleybuses, suburban railway rolling stock) updated within the federal project «Modernization of passenger transport in urban agglomerations» and having a service life not older than the standard») was attended not earlier than April 2023.

The figures for cargo and passenger turnover by mode of transport contain data from 2010 to 2021. Thus, the data is available in the Rosstat system, but not in the UNECE database.

It should be noted that the list of indicators considered in Russia is much wider than the official UN list and contains more detailed statistical information on railways and roads, as well as on the transport infrastructure quality index calculated from 2018.

RESULTS

The indicators used by UNECE to track SDG 9.1 are incomplete. It is advisable to expand them to cover all modes of transport, as well as to supplement them with indicators of the volume of investment in infrastructure by mode of transport. We propose to expand the list with the following ten indicators:

1. 9.1.2 Volume of cargo transportation (sea transport).

2. 9.1.2 Volume of cargo transportation (air transport).

3. 9.1.2 Volume of passenger transportation (inland water transport).

4. 9.1.2 Volume of passenger transportation (sea transport).

5. 9.1.2 Volume of passenger transportation (air transport).

6. 9.1.3 (a) Volume of investment in infrastructure (railway transport).

7. 9.1.3 (b) Volume of investment in infrastructure (road transport).

8. 9.1.3 (c) Volume of investment in infrastructure (inland water transport).

9. 9.1.3 (d) Volume of investment in infrastructure (sea transport).

10. 9.1.3 (e) Volume of investment in infrastructure (air transport).

The absence of data in the UNECE database does not mean that the country does not calculate the indicated indicators. On the example of the Russian Federation, we have shown that the data are present in the national statistical reporting, and in a more detailed version. It is not excluded that the similar situation concerns as well some other countries.

CONCLUSION

The underdevelopment of transport leads to increased trade costs, reduced export competitiveness and lower country's attractiveness for investment. It is impossible to develop high-quality, reliable, sustainable, and resilient infrastructure without monitoring the performance of all modes of transport and assessing the volume of investments in transport infrastructure. The number of indicators tracked in the UNECE database for SDG 9 is insufficient and needs to be expanded.

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Each country can decide whether or not to account values of indicators at the country level and whether to report data on them, however, the incompleteness of the data does not allow assessing the comparative dynamics in achieving the set goals and targets.

The expansion and unification of indicators for all countries will give a clearer understanding of progress in achieving the goals and objectives set for each mode of transport, as well as provide a comparative basis for decision-making in terms of priority areas for investment in transport infrastructure.

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