TRANSPORTATION NETWORKS

IN THE OIC MEMBER COUNTRIES

IMPACT ON TRADE AND TOURISM

OIC Outlook Series

April 2016

ORGANISATION OF ISLAMIC COOPERATION
STATISTICAL, ECONOMIC AND SOCIAL RESEARCH AND TRAINING
CENTRE FOR ISLAMIC COUNTRIES

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STATISTICAL, ECONOMIC AND SOCIAL RESEARCH AND TRAINING CENTRE FOR ISLAMIC COUNTRIES (SESRIC)

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INTRODUCTION

Transportation is an indispensable element in any economic activity. Without physical access to resources and markets, economic growth and development are not possible. An efficient multimodal transportation system is, therefore, a fundamental element in sustainable economic development. It facilitates the transfer and movements of people, goods, services and resources and improves access to local and international markets. The development of modern and efficient multimodal transportation infrastructures and services, together with adequate and coherent relevant laws and regulations, are also crucial factors for enhancing and strengthening regional economic cooperation and integration.

As a group, the OIC countries account for one sixth of the world's land area and enjoy a vast strategic trading region. In addition, they are well-endowed with potential economic resources in different fields and sectors, such as agriculture, energy and mining, tourism etc. In order for the OIC countries to maximize the efficient utilisation of these inherent potentials, with a view to enhancing trade and economic development and thus competitiveness and market integration, it is necessary, inter alia, to establish a multimodal transportation system which is functions efficiently not only at the individual country level but also at the OIC regional level. Improving transportation networks in and among OIC countries is, therefore, a key factor that has direct impacts on enhancing and strengthening trade and economic integration in OIC countries at both the regional and world trading system levels.

Transportation networks facilitate mass carriage of goods, which is of special importance to the OIC countries since the majority of them are producers of primary commodities, mainly fuel and agricultural products. Integrated transportation networks at both OIC regional and sub-regional levels would also be in harmony with the Islamic free trade area and the Islamic common market strategies of the OIC. The diverse geographic characteristics of the OIC countries, which are considered as a natural constraint for enhancing economic and commercial cooperation among them, make it necessary to fully utilise the already established transportation networks on the one hand, and to develop them further, on the other.

Yet, as the present report shows, the low level of transport capacity in OIC countries, as a group, has undoubtedly, reflected in poor transport performance and ineffective use of the existing transport facilities, a factor which has, among others, negative impact on trade and tourism activities in these countries. It is clear that the present situation of transportation networks in the OIC countries, in terms of both capacity and performance, is still far from reaching the desired level of impact on intra-OIC trade and tourism activities.

CAPACITY OF THE OIC COUNTRIES IN VARIOUS MODES OF MODERN TRANSPORT

A comparative look at the capacity of the OIC countries in different modes of modern transport reveals some key challenges ahead of intra-OIC cooperation in trade.

Road Transport

Road network length, when standardized on a per capita basis, can be considered a proxy for measuring the extent to which every person in any given country or region is served by roads. The length of road network per capita within the group of OIC member states is modest when compared to non-OIC developing countries, developed countries as well as the world average. Based on the most recent data available, the average road length for 1000 people living in the OIC member countries is calculated as 2.3 km, which compares poorly to the world average of 5.1 km (Figure 1 left panel). The average road density is 3.7 km in non-OIC developing economies. In developed economies, however, per 1000 resident people are served by as much as 14 km of road network.

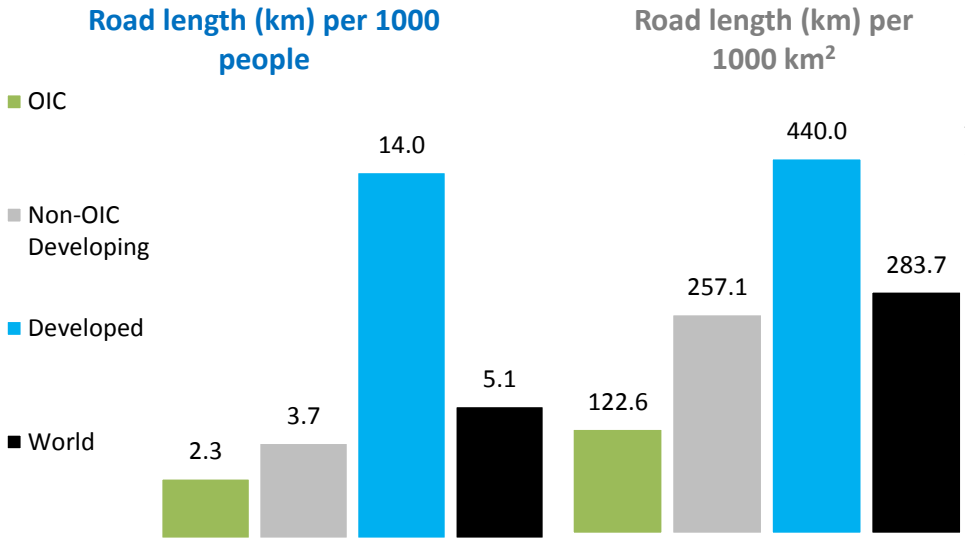


Figure 1

Road Network Density

2011 (For some countries earlier data is used).

Country group	road length km 1000 people	road length km per 1000 km2
OIC	2.3	122.6
Non-OIC Developing	3.7	257.1
Developed	14.0	440.0
World	5.1	283.7

Source: Appendix 1

When standardization is based on the land area, the average road network of 122.6 km per 1000 km^2 land area within the OIC countries group is almost half that of non-OIC developing economies (257.1 km) and less than one-third of that of the developed economies (440 km). The world average is currently 283.7 km (Figure 1 right panel). Measured through either approach, the results point to the strong need for further development of the road networks in the OIC member countries.

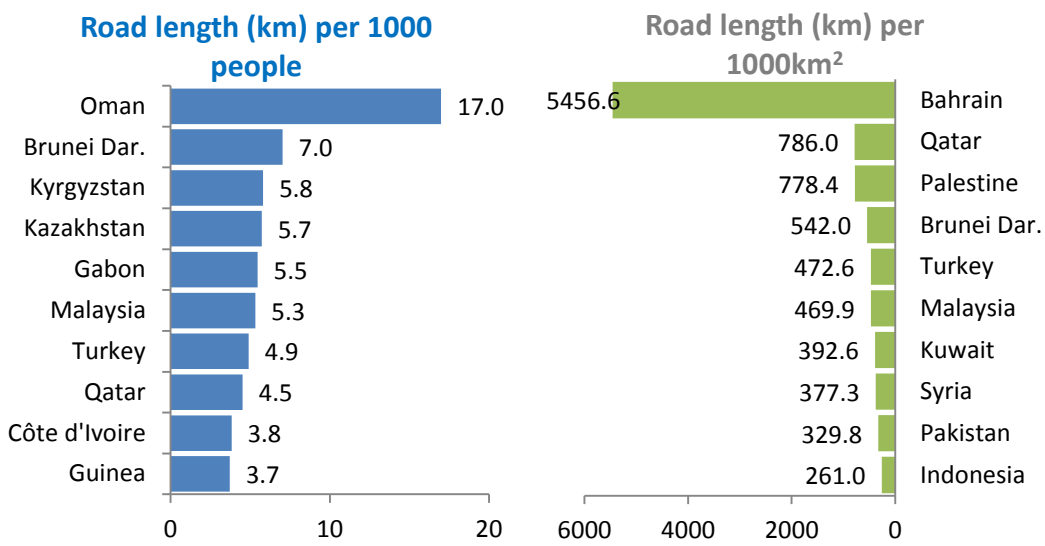


Figure 2

OIC countries with the Highest Levels of Road Network Density

2011

Source: Appendix 1

At the individual country level, Oman registered the highest level of road length, 17 km per 1000 people which is even higher than the developed countries average of 14 km per 1000 people. No other OIC country comes close to the developed countries average. However, all top ten OIC countries show equal or higher numbers of road length per 1000 people than non-OIC developing countries as a group (Figure 2 left panel).

The top 10 OIC countries performed better in terms of road length per 1000 km^2 land area of the countries territory. Bahrain, Qatar, Palestine, Brunei Darussalam, Turkey and Malaysia recorded higher road density levels per 1000 km^2 than the developed countries average (Figure 2 right panel). Also, Bahrain is among the top 5 countries in the world in this indicator.

Rail Transport

Heavy industries are traditionally linked to the rail transport systems and the containerization improves the flexibility of rail transportation by linking it with road and maritime modes. The average length of railway serving 100,000 people is only 6.9 km within the group of OIC countries while the world average is 16.4 kilometres – more than double that of OIC countries (Figure 3 left panel). The poor figures in the OIC countries are mainly caused by the stagnant rail line infrastructure growth coupled with the increasing population. Non-OIC developing economies are also lagging behind the world with their average 10.9 km of railway length, which is far below the average 48.6 km rail network in operation for every 100,000 people resident in the developed countries.

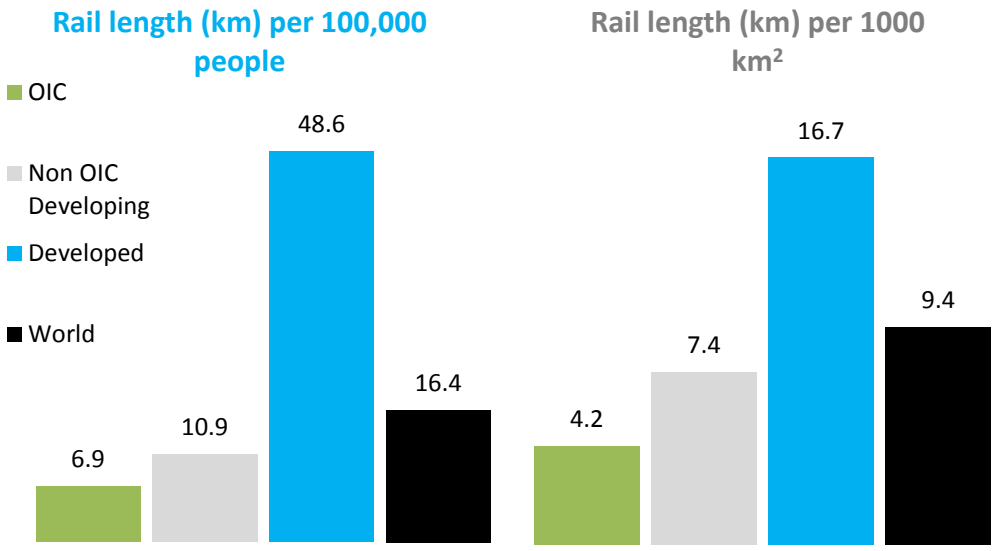


Figure 3

Rail Network Density

2012 data

	Rail length per 100,000 people	Rail length per 1000 km land area
OIC	6.9	4.2
Non-OIC Developing	10.9	7.4
Developed	48.6	16.7
World	16.4	9.4

Source: Appendix 2

In terms of land coverage, again, the average 4.2 km of railway per 1000 km^2 land area of the OIC countries is almost half that of the group of non-OIC developing economies, which averages at 7.4 km (Figure 3 right panel). It is observed that the improvement in overall railway figures for the OIC countries as a group has so far been relatively poorer in comparison to those of non-OIC developing countries and the world.

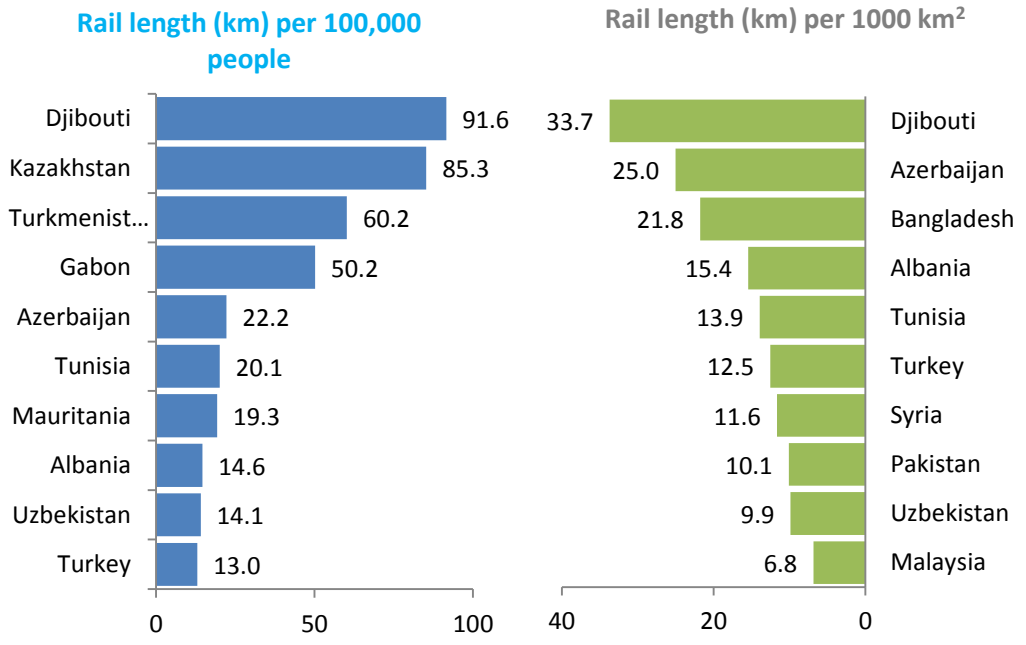


Figure 4

OIC Countries with the Highest Rail Network Density

2012 data is used.

Source: Appendix 2

Globally, Djibouti is the top country in terms of having the highest rail network density in the world. This is mainly due to the relatively small land area and population of the country. Rail length in Djibouti was equal to nearly 92 km per 100,000 people and 34 km per each 1000 km^2 of the country's land area, in 2012. In comparison, Kazakhstan has the largest total rail length among OIC countries, at 14,319 km, also ranked as 18^{th} in the world.

Djibouti, Kazakhstan, Turkmenistan and Gabon, have higher levels of rail network density in per capita terms, than the developed countries average. Also, three OIC countries; Djibouti, Azerbaijan, and Bangladesh have a higher rail network density per 1000 km^2 land area compared to the developed countries average of 16.7 km.

Air Transport

Beyond the benefits of fast and inexpensive transcontinental travel, air transport also is now a vital mode for shipping high-value goods that need to come to market quickly, such as agricultural products subject to spoilage. Air transport has become an essential economic and social conduit throughout the world. According to the World Health Organization (WHO), it is now the primary mode of transport for tourism activities.

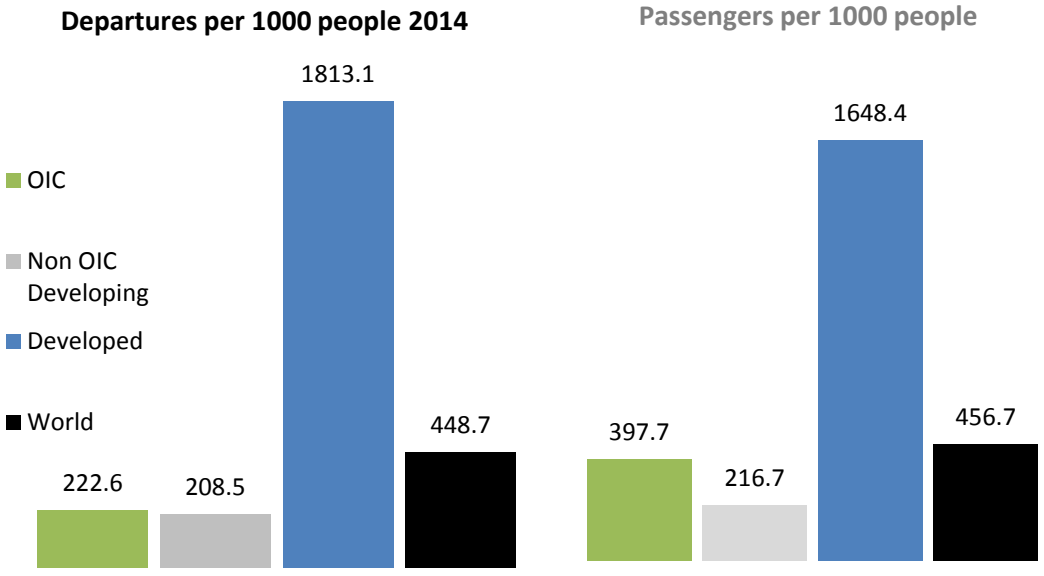


Figure 5

Air Network Density

2014 data is used.

	Departures per 100,000 people, in 2014	Passengers per 1000 people, in 2014
OIC	222.6	397.7
Non-OIC Developing	197.6	216.7
Developed	1657.7	1648.4
World	448.7	456.7

Source: Appendix 3

The average number of air passengers in the OIC countries, measured on per 1000 people basis, is still below the desired levels. According to the SESRIC staff calculations based on the World Bank WDI dataset, in 2014, the density of the domestic and international

passengers carried by aircrafts registered in the OIC countries is calculated as 397.7 per 1000 people (Figure 5 right panel). The world average is 456.7 passengers. Non-OIC developing countries, on the other hand, are below the OIC countries as a group with an average density of 216.7 passengers. Moreover, average pace of growth in the OIC member countries and non-OIC developing countries were almost the same between 2010 and 2014. In 2010, the passenger density in non-OIC developing countries was 158.1 while, in OIC countries, this indicator was equal to 285.7 per 1000 residents.

The low frequency of air travel in the OIC countries has to some extent been reflected in the small number of aircraft departures compared to the world average. Figure 5 reveals that the density of domestic and international take-offs by carriers registered in the OIC countries is only 222.6 per 100,000 people while the world average is 448.7 departures for the same number of people (Figure 5 left panel).

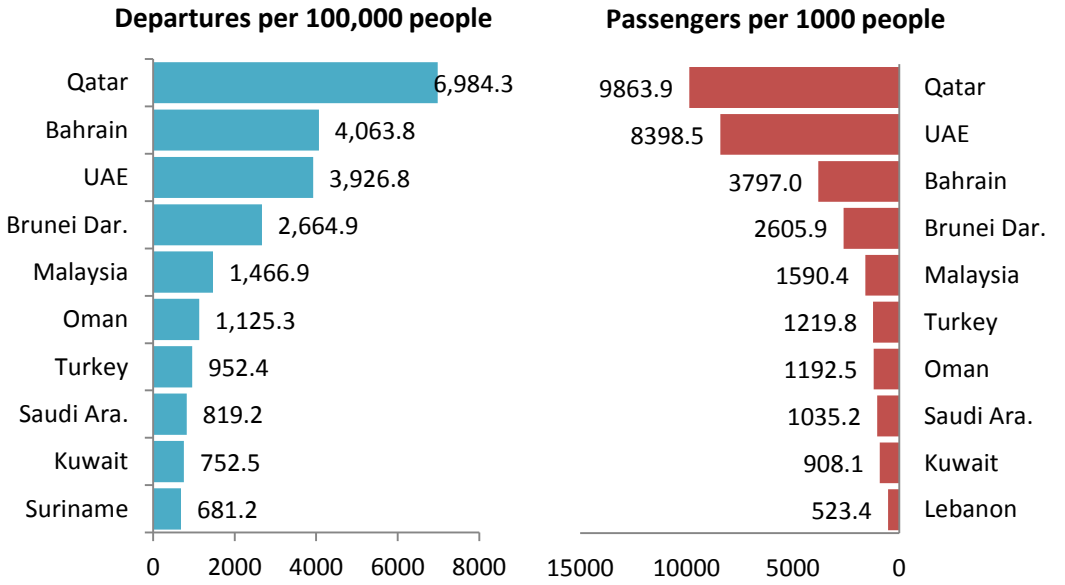


Figure 6

OIC Countries with the Highest Air Network Density

2014 data is used.

Source: Appendix 3

Figure 6 shows the top 10 OIC countries according to air network density. Both in terms of departures per 100,000 people and passengers per 1000 people, four OIC countries; Qatar, Bahrain, UAE and Brunei Darussalam performed better than the Developed countries average. Only the top 10 OIC countries plus Jordan, Libya and Lebanon registered higher numbers of departures per 100,000 people than the world average. Similarly, these OIC countries except Libya recorded higher numbers of passengers per 1000 people compared to the world average.

The low levels of air traffic observed in the rest of the OIC countries can be attributed to the lack of infrastructure facilities such as proper terminals and paved runways which are very low in number and size.

Sea Transport

With more than 100,000 km of total coastline, OIC countries possess significant potential for maritime trade. Yet, the current level of container throughput – expressed in tonnes per 1000 people – in the group of OIC member countries is far from enabling the group to fully utilize this potential. The total container throughput per 1000 people is measured as only 76.5 tonnes compared to the world average of 101.4 tonnes (Figure 7). Non-OIC developing countries as a group are slightly below the OIC member countries with 75.5 tonnes per 1000 people.

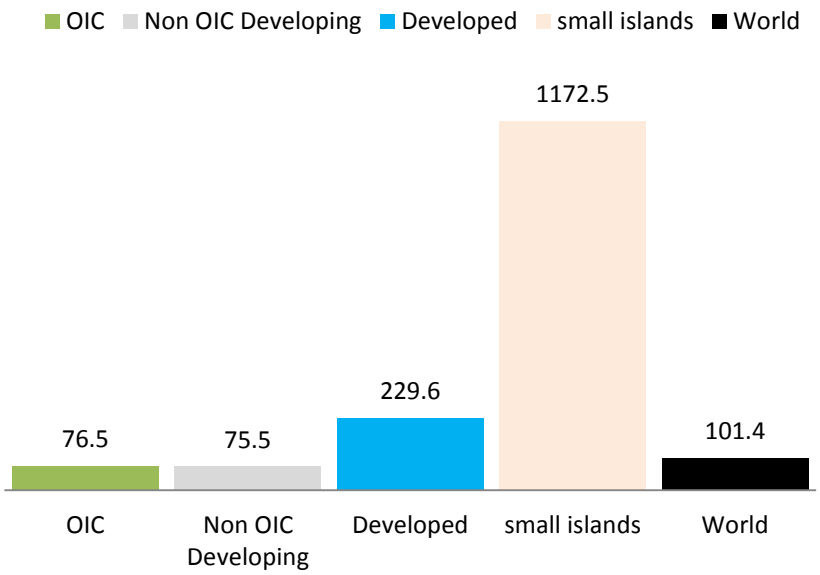


Figure 7

Container port throughput 2014, *tonnes per 1000 people*

Source: Appendix 7

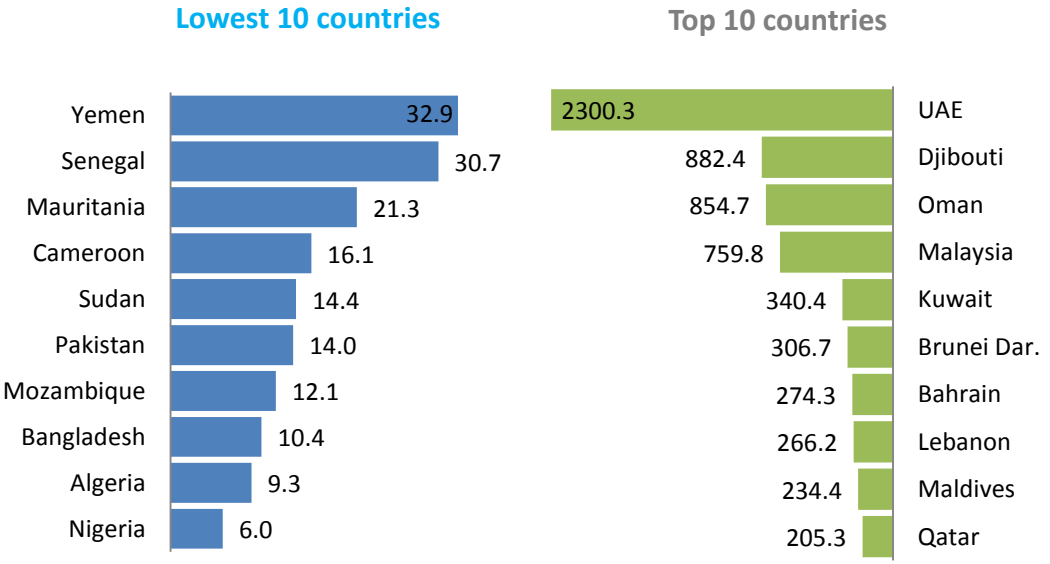


Figure 8

OIC countries with Highest and Lowest Container throughput,

tonnes per 1000 people

Data 2014

Source: Appendix 4

At the individual country level, the top ten OIC countries have successfully exploited their maritime transportation capacities. All top ten countries (except Qatar) have demonstrated higher volumes of container throughput per 1000 people than the developed countries (Figure 8 right panel).

On the other hand, several OIC countries with long coastlines registered very low quantities of container throughput per 1000 people (Figure 8 left panel). Most probably, this is a consequence of political, economic or social instability in these countries that prevent them from benefiting more from their potentials.

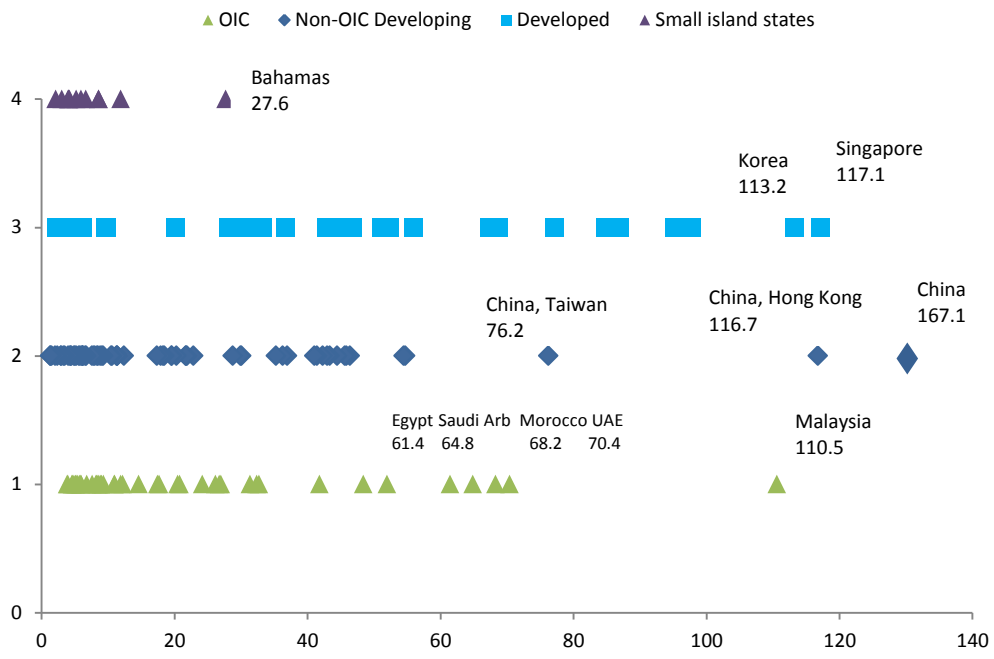


Figure 9

Liner Shipping Connectivity Index 2015

Source: UNCTADstat Online Database

Liner Shipping Connectivity Index[1] aims at capturing a country's integration level into global liner shipping networks. The index is generated from five components[2], which are mainly related to the maritime capacity of the country. According to this index, the majority of the OIC countries have poor shipping connectivity performances ranging between 0 and 35 index units (Figure 5). Malaysia, United Arab Emirates, Morocco, Saudi Arabia, and Egypt are the OIC countries with the highest index values. These countries also outperform non-OIC developing countries other than China, Hong Kong and Taiwan. Almost half of the developed countries (14 out of 31 observed), on the other hand, stand out with their high maritime capacities indicated by index values greater than 50 index units.

The modest transport development figures in various transport modes presented above indicate that transportation infrastructure in the OIC countries is incompetent and the transportation system as a whole offers poor connectivity, which is an essential ingredient of enhanced trade cooperation among the member states.

[1] Index is based on the country with the highest index value in 2004 (China=100).
[2] These are number of ships, total container carrying capacity, max. vessel size, number of services and number of container shipping companies.

PERFORMANCE OF THE OIC COUNTRIES IN VARIOUS MODES OF MODERN TRANSPORT

The underdeveloped transport infrastructure coupled with poor transport links between the OIC member states has long stifled intra-OIC cooperation in trade and tourism.

Some OIC countries have achieved tremendous results in air passenger and goods transportation. According to the Airports Council International (ACI)'s preliminary passenger traffic results for 2014 Dubai is the world's 6th busiest airport. Although Dubai is the sixth busiest airport in the world in overall passenger traffic, it has actually become the world's busiest in terms of international passenger traffic ahead of London-Heathrow in 2014. Dubai was just shy of reaching the 70 million international passenger mark by the end of 2014.[3]

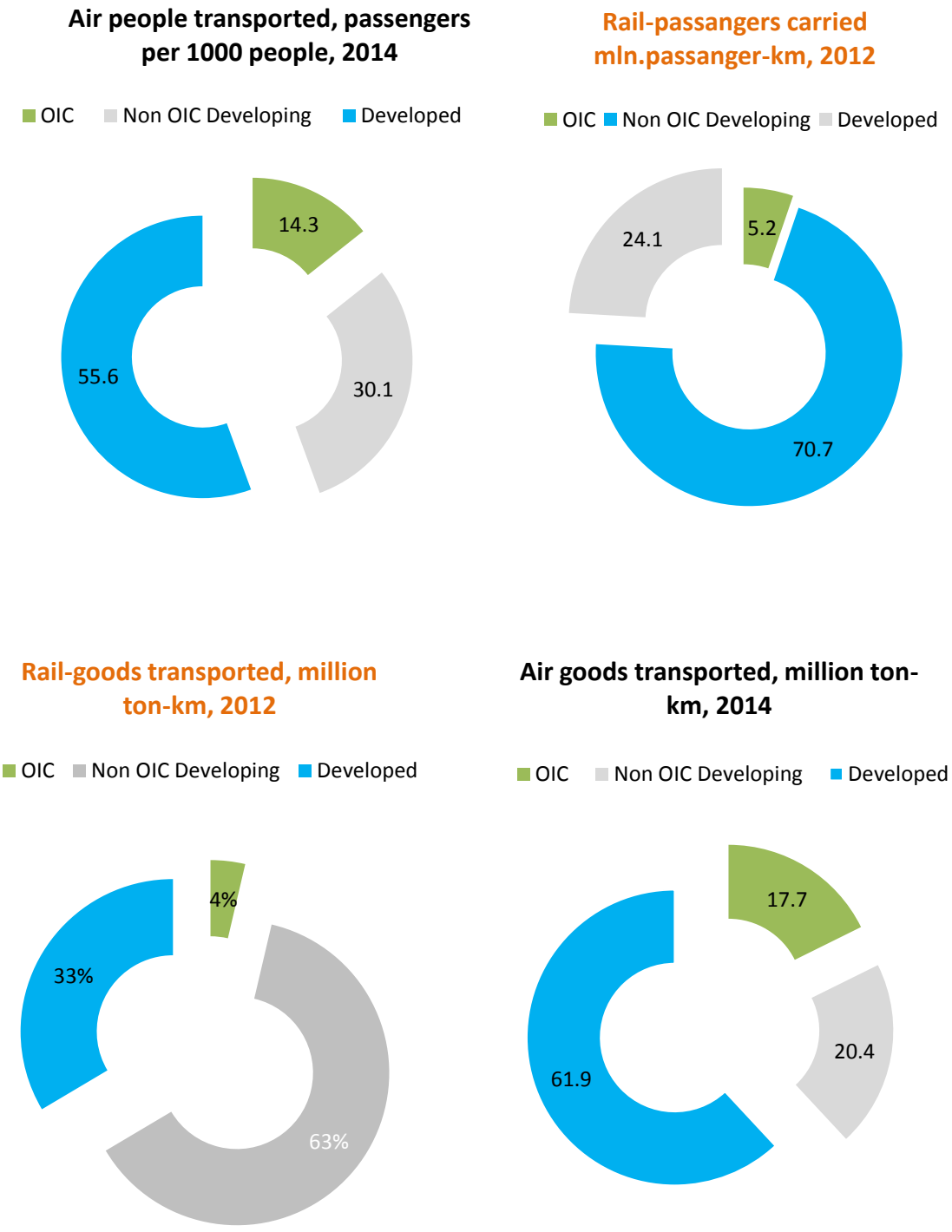
Also according to the same source, Istanbul remains one of the fastest growing airports among the world's top 20 airports for passenger traffic, moving from 18th to 13th rank ahead of Amsterdam.[4]

However, even the busiest airports in the OIC member countries, such as Jakarta[5], Dubai[6], Kuala Lumpur[7], international airports, have direct flights to only a few OIC countries. For example, Emirates flies to 79 countries from its hub in Dubai of which only 28 is OIC countries.[8] This inadequate direct air link observed even at the busiest airports, and the resulting higher freight and human transport costs and times among the OIC countries compound the inability to operationalize intra-OIC trade and tourism cooperation efforts. On the other hand, although the group of OIC countries comprises mainly of countries that are adjacent to each other, the poor rail connectivity among adjacent OIC member countries undermines the prospects for building efficient trade corridors. Many OIC member countries have no railway connections to adjacent member states and many others face the *break-of-gauge* problem which leads to an increase in the duration and cost of rail shipments. Thus, apart from the negative impacts of the poor transport development on *overall* OIC trade and tourism volume, the poor rail connectivity among the adjacent member countries pose an additional challenge to creating a stronger *intra*-OIC cooperation in bulk trade.

Indeed, the performance of the OIC countries in two major modes of passenger and goods transport was modest during the observed years. The group of OIC member countries accounted for only 4 and 5.2 percent of the total goods and people transported through the rail networks in the world during 2012, respectively (Figure 10). The OIC member countries as a group had slightly better figures in air transport with shares of 17.7 and 14.3 percent in total air freight and passengers carried on planes during 2014, respectively.

[3] Airports Council International , ACI World releases preliminary world airport traffic and rankings for 2014 accessed at http://www.aci.aero/
[4] ibid
[5] 12th busiest airport by passenger traffic according to Airports Council International (ACI) 2013 data.
[6] 13th busiest airport by passenger traffic according to Airports Council International (ACI) 2013 data.
[7] 28th busiest airport by passenger traffic according to Airports Council International (ACI) 2013 data.
[8] Emirates Destinations, accessed at http://www.emirates.com/

Figure 10. Share of OIC Countries in Rail and Air Transport



Source: World Bank WDI Online Database

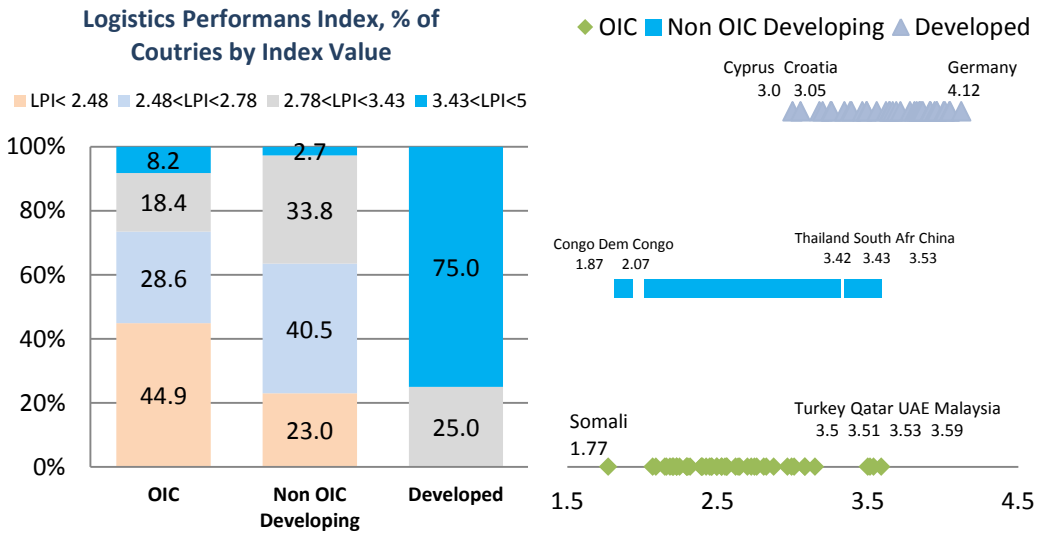


Figure 11

Logistics Performance Index.

*Source: World Bank WDI Online *Thresholds are based on World Bank classification*

Clearly, the poor average transport capacity figures observed in the group of OIC member countries translates into incompetency in logistics, which is the backbone of trade. Logistics Performance Index measures the performance of a country along its logistics supply chain and provides qualitative evaluations of that country in six areas, four of them[9] being directly linked to the level of transport development. According to this index, as of 2015, 45 percent of the OIC countries (22 out of 49 observed) had poor logistics performance figures below 2.40 index units (Figure 11 left panel), while only 23 percent of non-OIC developing countries (34 out of 148 observed) were below this threshold. Malaysia (3.59) and Somalia (1.77) were the two OIC member countries with the highest and lowest logistics performance index values, respectively (Figure 11 right panel). In contrast, 75 percent of the developed countries recorded index values greater than 3.43 index units and 25 percent recorded values between 2.78 and 3.43. There was no developed country with index value below 2.78.

LINKING TRANSPORTATION TO TRADE AND TOURISM

From an economic development point of view, efficient transportation system can positively affect the pace of growth and development of trade and tourism activities through at least four ways (Weisbrod, 2008):

i. by enabling *new forms of trade* among industries and locations;
ii. by reducing *carrying cost* and enhancing *reliability* of existing trade and tourism movements;
iii. by expanding the *size of markets* and enabling *economies of scale* in production and efficient distribution of goods and services; and
iv. by increasing *productivity* through access to more diverse and specialized labour, supply and buyer markets.

In the light of this argument, the impact of transportation on trade and tourism is highlighted in this section through examining the relation between the capacity in key transport indicators

[9] These are infrastructure, international shipments, logistics competence and timeliness.

and per capita trade performance at the country level. The data on the transport capacity covers the period starting from the year 2007 to 2014 whereas the data on per capita trade and tourism figures are averaged over the period 2005-2015 for each country. For road transport, Figures 12a and 12b indicate a strong relationship between the growth in per capita trade volume and the road infrastructure development. The relationship between the two indicators is almost linear, implying that the growth in the per capita road network is linked to the increase in trade and tourism volume on a constant scale.

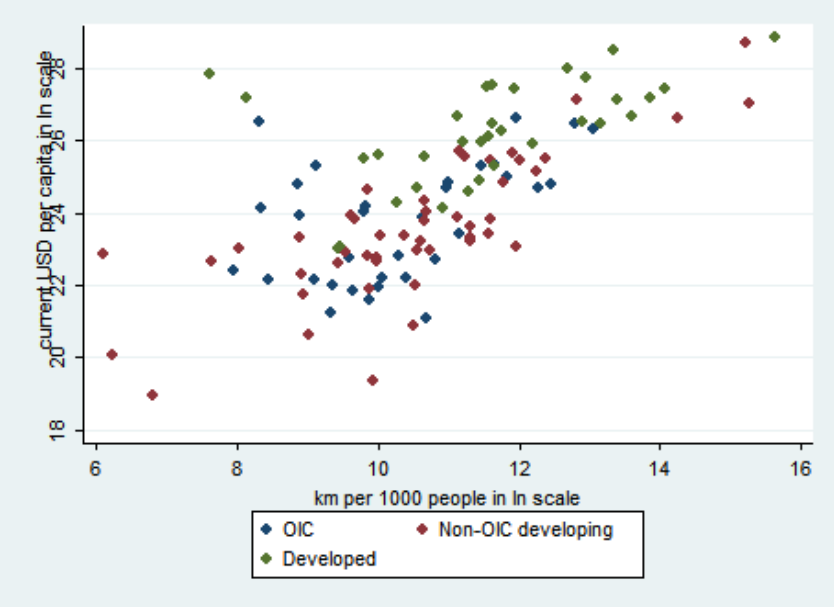


Figure 12a

Trade volume and road network density

Source: World Bank WDI Online, UNCTAD and SESRIC Staff Calculations

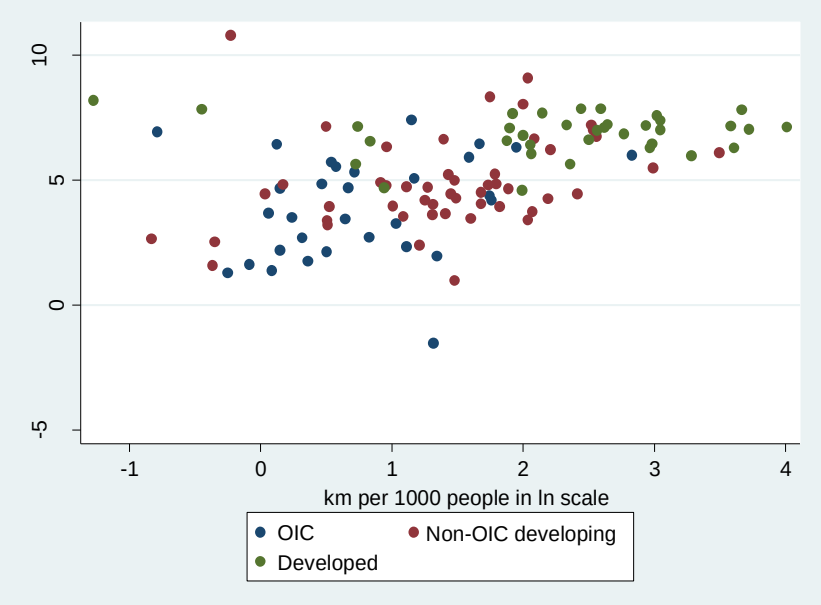


Figure 12b

Tourism volume and road network density

Source: World Bank WDI Online and SESRIC Staff Calculations

It is also clear from the figures that the OIC countries, with low road density, have a significant potential for increasing their trade and tourism volumes by improving their road network infrastructure. The OIC member countries apparently cluster in the low trade (tourism) volume-low road density region. The clustering of non-OIC developing and

advanced country groups in the middle and upper parts of the figure is also evident, indicating that these countries achieved higher trade and tourism volumes in return for their higher levels of road network development. The lack of investment in road infrastructure seems to set back the ability of the member countries to increase their trade and tourism, thus putting them behind the non-OIC developing and developed countries.

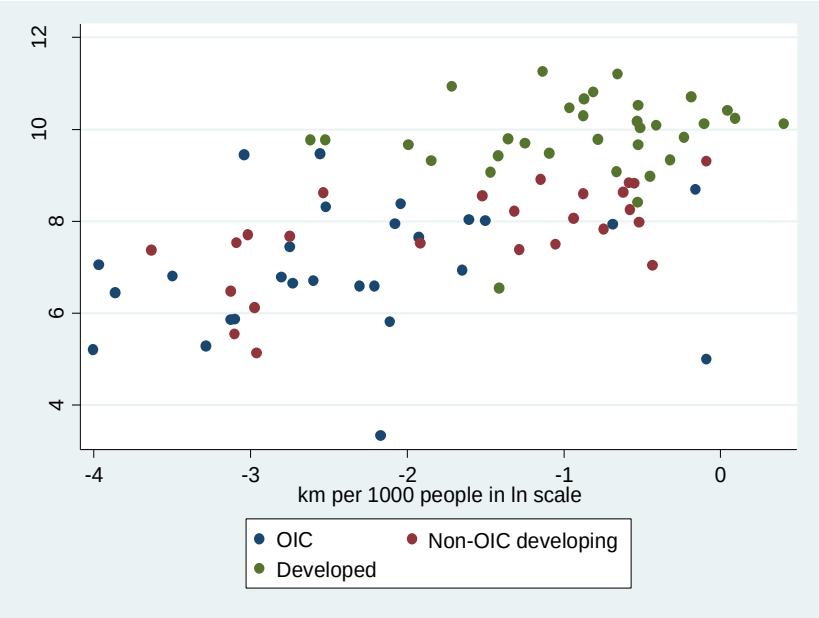


Figure 13a

Trade volume and rail network density

Source: World Bank WDI Online, UNCTAD and SESRIC Staff Calculations

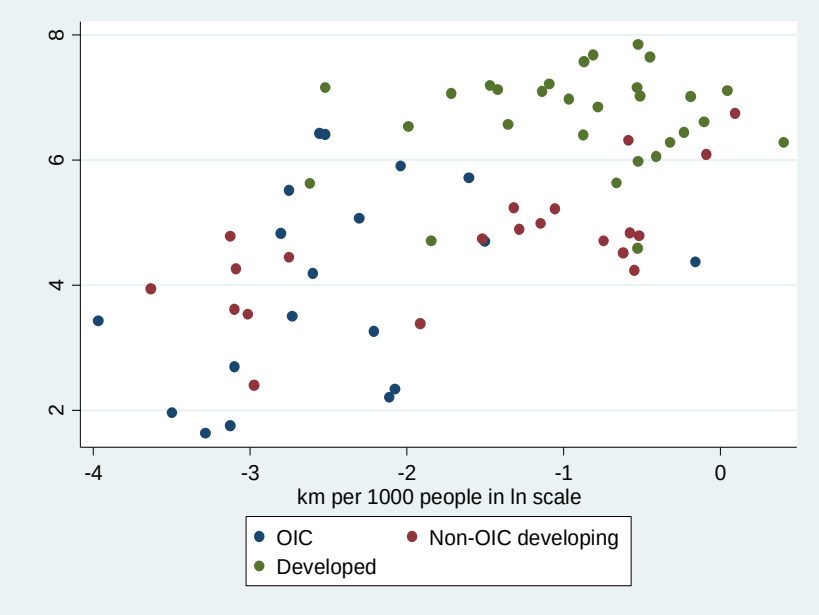


Figure 13b

Tourism volume and rail network density

Source: World Bank WDI Online and SESRIC Staff Calculations

A similar result is observed in the case of rail network. In this regard, Figures 13a and 13b reveal significant mutual relationships between the rail per capita growth and the growth in per capita trade and tourism volumes. Again, the OIC countries appear mainly in the low trade (tourism) volume-low rail per capita region and the positive linear relationship between the indicators are preserved in each country sub-group included in the figures 13a and 13b.

The strong correlation between rail transport capability and trade performance offers a motivation for the OIC member states with underdeveloped rail infrastructures to extend their rail networks. For example, in the landlocked Uganda only an approximate 300-km portion of the total 1,266 km rail network is operational and it lacks connections to the neighbouring countries such as Sudan, Congo (DR), Rwanda and Tanzania, 3 out of which have direct access to sea. Other lines were closed mainly due to their technical deficiencies. Railways carry less than 10 percent of export and import traffic in Uganda. Transit time to the Port Mombasa of the adjacent Kenya is about 10 days (Itazi, 2010).

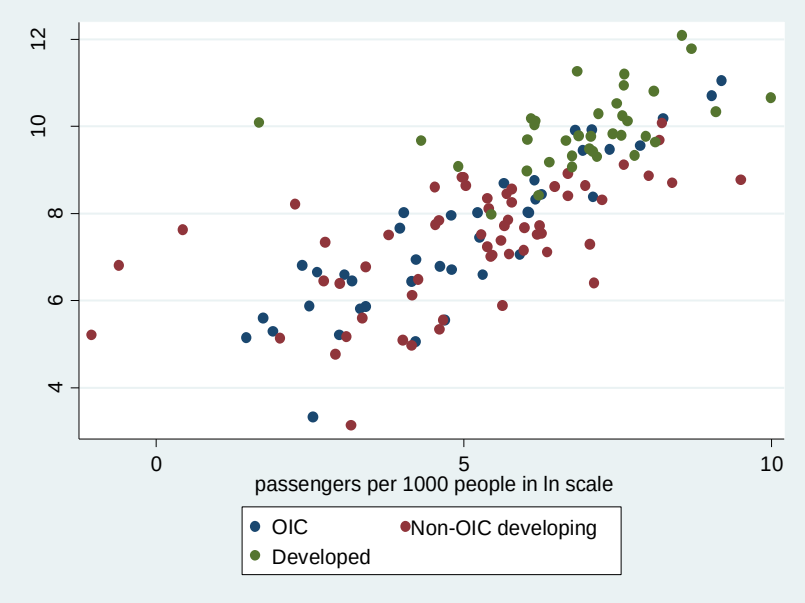


Figure 14a

Trade volume and air network density

Source: World Bank WDI Online, UNCTAD and SESRIC Staff Calculations

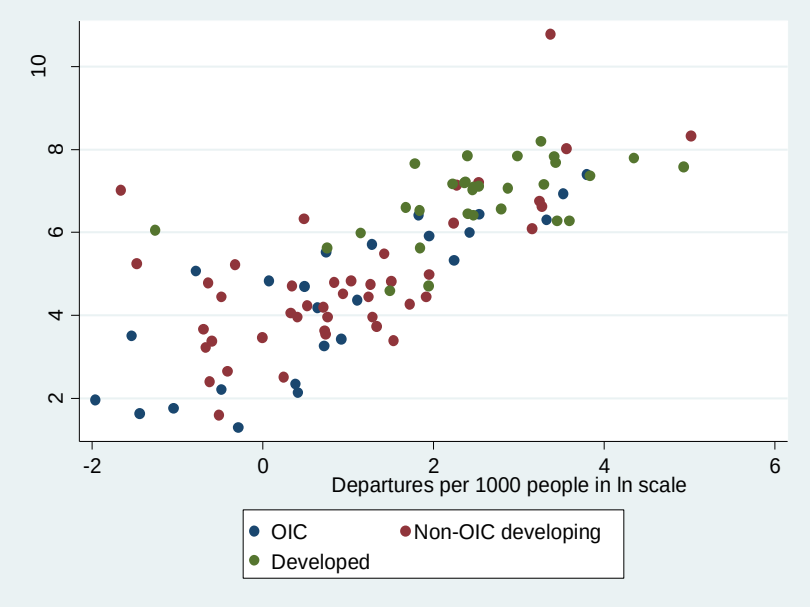


Figure 14b

Tourism volume and air network density

Source: World Bank WDI Online and SESRIC Staff Calculations

Despite the considerably varied air transport capabilities in OIC countries, the structural link between the development of air transport and trade and tourism levels is much more clear (Figures 14a and 14b). Developed economies again cluster at the upper right corner of the figure where the higher per capita trade and tourism volumes are associated with the higher levels of development in the air transport sector. The OIC countries are apparently represented on a large scale of air transport capabilities, where the member countries with a more developed air network performing better in trade and tourism activities.

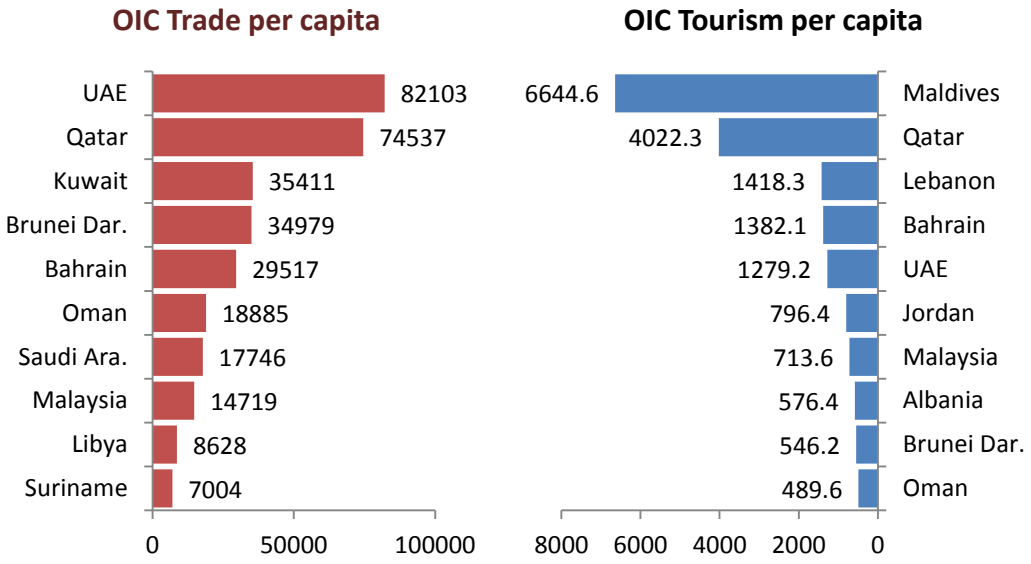


Figure 15

Top OIC Countries in Trade and Tourism

2014

Source: United Nations UNCTAD dataset, World Bank WDI Online Database and SESRIC Staff Calculations

Figure 15 (left panel) provides information about the trade volumes of the top trading OIC countries. OIC member countries such as UAE, Qatar, and Kuwait are among the leading countries in the world in terms of per capita trade, according to the UN Commodity Trade Database. Over the last decade, these countries achieved rapid development of foreign trade, owing to their port capacities, infrastructure, and conducive environment for doing business.

Maritime transportation is indeed the most important mean of goods transportation. Top trading OIC countries generally have high volumes of container throughput (see Figure 15 left panel and Figure 8 right panel). Rail and road networks serve as an alternative to maritime transportation for landlocked countries. It clearly prescribes the importance of ports followed by the road and rail infrastructure development for increasing trade volumes at current levels of industrial and economic development of the OIC countries. Meanwhile, tourism is strongly interconnected with air network density, according to Figure 6 and Figure 15 (right panel).

CONCLUDING REMARKS AND RECOMMENDATIONS

The current level of transport capacity and performance in the OIC countries points to a strong need for more progress in transportation development within the group of OIC countries. When the average transportation figures of the OIC countries, as a group, are related to the figure of either population or land area, they remained lagging compared to the world average. In terms of rail and road network density OIC countries as a group are lagging behind from the rest of the developing countries as well. But in terms of the air and maritime transport OIC countries performed slightly better than non-OIC developing countries thanks to the few OIC countries achievements.

In this framework, OIC countries face critical obstacles and challenges in the field of transportation in particular in connection to trade and tourism. Already inadequate infrastructure and maintenance services cannot be improved considerably due to insufficient financing resources and investment in transportation sector and transportation infrastructure projects. Complex and prolonged customs and border-crossing procedures, especially in land-locked member countries, prevent the development of trade and transportation.

Another challenge faced by OIC countries is inadequate implementation of trade and transport facilitation measures and lack of information and knowledge-sharing among OIC member countries in this area. Lack of a sound, harmonized, and adequate legal and regulatory frameworks, both at national and OIC regional level further exacerbates this challenge. Moreover, OIC countries lack the adequate human and institutional capacity of relevant transportation authorities. The use of Information and Communication Technologies (ICT) in the area of transport, trade facilitation and tourism is also lagging.

In the light of the above-identified obstacles and challenges, the following recommendations can be made at both national and OIC cooperation level.

At the national level, the solution of infrastructure problems requires sustainable longer-term investment and involvement of the private sector in transport project investments through OIC joint venture transport projects. Measures should be developed to improve maintenance of existing roads, railways, seaports and airports as well as to improve the quality of these transport modes services. Efficient resources should be allocated to the projects, programs and studies in transport sector, in collaboration with regional and international financial institutions.

More attention from private investors should be attracted through rational incentives. Private investments via Public-Private Partnership (PPP) scheme have become popular around the world as a tool for improving transport infrastructure.

Transport sector reform has to be set in the context of general reform of public institutions and transport development plans should be integrated into their national strategies taking into consideration regional initiatives. National Trade and Transport Facilitation Committees (NTTFC) can be established for better coordination among private and public sectors institutions. This can help to identify the major transport related obstacles to tourism in the member countries by increasing coordination among the ministries of transport and tourism. Such mechanisms should be further improved by developing tools for knowledge-sharing on

best practices and using ICT for trade and transport facilitation and tourism in cooperation with relevant regional and international organizations.

At the OIC cooperation level, developing an OIC regional transport approach requires close cooperation and coordination between the member countries as well as the different organization and agencies involved. It also requires concluding of framework agreement on the priorities both in the infrastructure and policy areas. High level policy coordination among Ministers of Transport in member countries can help promote dialogue on the challenges and problems facing the sector in the OIC region.

Creating a database of statistical information from the OIC member countries in the field of transport and exchanging of information among OIC member countries about their domestic and international transport facilities can help improve the networks throughout the OIC. Enhancing partnership with relevant regional and international organizations in the field of transport to avoid duplication and enhance effectiveness. In this framework, a master plan for the transport corridors in the OIC Member States including identification of the obstacles on the existing transport corridors in the OIC sub-regions should be prepared. Projects similar to the Port Sudan-Dakar railway line project should be designed and implemented to create grounds of cooperation among OIC member states in the field of transportation.

Due to the significant variations in the spatial distribution of population, the intensity of economic activities and the level of economic development among the member countries, the potential solutions to poor transport development should be tailored to the challenges faced by each individual country. Particularly for the land-locked member countries, the land transport is vital to economic development as the infrastructure development significantly contributes to the economic growth by reducing production costs, contributing to the diversification of the economy and, most importantly, linking these regions to transport corridors. In this regard, the OIC effort to coordinate OIC transport related activities as well as activities of the Transport Corridor Europe – Caucasus – Asia (TRACECA) and the UN Special Programme for Central Asia (SPECA) is worthwhile.

REFERENCES

Itazi, G. J. (2010). Current Plans for Existing and Development of New Railways in Uganda. Speech by Director of Transport, Ministry of Works and Transport (Uganda) at the 2010 East Africa Railways Conference.

SESRIC, (2009) Transportation Sector in OIC Member Countries. Outlook Report, May.

SESRIC, BASEIND Database.

United Nations Conference on Trade and Development (UNCTAD) Statistics Online Database, UNCTAD

Weisbrod, G. (2008), Models to predict the economic development impact of transportation projects: historical experience and new applications. Springer-Verlag Special Issue Paper, *Annals of Regional Science*, 42:519–543.

World Bank, World Development Indicators (WDI) Online Database.

Appendix 1: Road Network Density

Country	km per 1000 km^2 land area					km per 1000 inhabitants				
Name	1990	1995	2000	2005	Most* Recent	1990	1995	2000	2005	Most* Recent
Afghanistan	32	32	32	53	35	1.13	1.01	0.89	1.30	0.78
Albania		657	657	657			5.74	5.87	5.79	
Algeria	37	43	44	45	48	3.49	3.62	3.41	3.30	3.04
Azerbaijan	630	322	332	715	219	7.32	3.49	3.40	7.05	1.95
Bahrain	3835	3993	4593	4927	5457	5.37	4.91	5.02	4.81	3.15
Bangladesh	1444	1567	1594	1838		1.63	1.59	1.47	1.56	
Benin	61	61	61	172		1.42	1.19	1.02	2.41	
Brunei Darussalam	192	322	218	693	542	3.93	5.76	3.45	9.86	7.04
Burkina Faso	36	46	46	338	56	1.12	1.23	1.07	6.73	0.92
Cameroon	72	73	106	109	105	2.79	2.44	3.15	2.88	2.28
Chad	24	26	27	32		4.86	4.59	3.98	3.99	
Comoros			473	473				1.63	1.47	
Cote d'Ivoire	155	158	158	252	254	3.92	3.35	2.92	4.16	3.83
Djibouti	124	125	132			5.14	4.63	4.20		
Egypt	46	58	64	93	137	0.80	0.91	0.91	1.20	1.59
Gabon	29	30	33	36	34	8.17	7.05	6.86	6.70	5.47
Gambia	239	264	270	374		2.66	2.43	2.07	2.45	
Guinea	121	123	124	180	176	4.82	4.05	3.64	4.81	3.73
Guinea-Bissau	146	155	156	123		4.01	3.73	3.37	2.35	
Guyana	36	40	40			9.46	10.31	10.54		
Indonesia	159	181	196	216	261	1.63	1.71	1.73	1.78	1.91
Iran	80	96	103	106	131	2.41	2.65	2.61	2.49	2.81
Iraq	96	106	104	103	96	2.23	2.15	1.81	1.58	1.27
Jordan	83	76	82	86	81	2.32	1.61	1.51	1.40	1.13
Kazakhstan	59	56	44	34	36	9.69	9.56	8.02	6.00	5.73
Kuwait	222	245	250	323	393	1.86	2.42	2.03	2.27	2.05
Kyrgyz Republic	98	97	96	96	170	4.27	4.05	3.76	3.60	5.82
Lebanon	623	622	714	681		2.14	1.82	1.94	1.71	
Libya	42	46	47	57		16.95	16.88	15.56	16.89	
Malaysia	164	186	202	283	470	2.98	2.96	2.85	3.63	5.32
Maldives										
Mali	11	12	12	15	18	1.55	1.55	1.43	1.58	1.37
Mauritania	7	7	7	9	11	3.67	3.35	2.94	3.06	3.02
Morocco	133	136	129	129	131	2.40	2.25	2.00	1.89	1.78
Mozambique	34	38	39		38	1.99	1.88	1.67		1.16
Niger	9	8	8	15	15	1.48	1.06	0.92	1.41	1.09
Nigeria	134	212	213	212		1.25	1.75	1.56	1.37	
Oman	76	99	106		195	12.83	14.04	13.65		16.99
Pakistan	219	278	311	335	330	1.57	1.75	1.73	1.66	1.43
Palestine				830	778				1.40	1.16
Qatar	99	104	106		786	2.46	2.30	1.99		4.53
Saudi Arabia	70	71	76	111		8.58	7.76	7.37	9.58	
Senegal	72	76	76	71	76	1.83	1.69	1.47	1.20	1.06
Sierra Leone	158	158	158	158		2.77	2.83	2.68	2.21	
Somalia	33	35	35			3.15	3.39	2.99		
Sudan	4	5	5			0.38	0.38	0.34		
Suriname	27	29	29	28		10.20	10.26	9.62	8.61	
Syria	181	202	227	205	377	2.61	2.54	2.53	1.96	3.23
Tajikistan	213	198	198			5.63	4.79	4.50		
Togo	136	138	138		205	1.88	1.70	1.43		1.65
Tunisia	129	145	122	124	119	2.46	2.51	1.99	1.92	1.71
Turkey	477	495	501	555	473	6.55	6.23	5.81	6.00	4.91
Turkmenistan	45	48	51	125		5.81	5.40	5.33	12.10	
Uganda				359					2.47	
United Arab Emirates	52	57	58	48	49	2.31	1.96	1.49	0.99	0.46
Uzbekistan	170	188	192			3.53	3.51	3.31		
Yemen	97	122	123	135		4.15	4.16	3.58	3.39	
OIC Countries	**83**	**92**	**95**	**125**	**123**	**2.53**	**2.52**	**2.35**	**2.52**	**2.30**
Other Developing Countries	**178**	**148**	**170**	**227**	**257**	**2.74**	**2.64**	**3.02**	**3.54**	**3.66**
Developed Countries	**418**	**432**	**594**	**893**	**440**	**15.19**	**15.03**	**15.18**	**14.57**	**14.02**
World	**222**	**202**	**233**	**274**	**284**	**4.69**	**4.53**	**4.67**	**5.20**	**5.07**

* 2007 or later

Source: World Bank, World Development Indicators

Appendix 2: Rail Network Density

Country	km per 1000 km^2 land area					km per 1000 inhabitants				
Name	1990	1995	2000	2005	Most* Recent	1990	1995	2000	2005	Most* Recent
Afghanistan										
Albania	26.79	24.60	16.06	16.31	15.44	0.22	0.22	0.14	0.14	0.15
Algeria	1.80	1.80	1.59	1.50	1.97	0.17	0.15	0.12	0.11	0.13
Azerbaijan			25.62	25.67	25.02			0.26	0.25	0.22
Bahrain	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Bangladesh	21.09	20.79	21.26	21.93	21.78	0.02	0.02	0.02	0.02	0.02
Benin										
Brunei Darussalam				2.47					0.04	
Burkina Faso				2.27	2.27				0.05	0.04
Cameroon	2.34	2.13	2.13	2.06	2.07	0.09	0.07	0.06	0.05	0.05
Chad	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Comoros	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Cote d'Ivoire	2.23	2.01	2.01	2.01	2.01	0.06	0.04	0.04	0.03	0.03
Djibouti	4.31	4.31	4.31	4.31	33.69	0.18	0.16	0.14	0.12	0.92
Egypt	4.77	4.83	5.05	5.17	5.22	0.08	0.08	0.07	0.07	0.06
Gabon	2.65	2.65	3.16	3.14	3.14	0.74	0.63	0.66	0.59	0.50
Gambia	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Guinea										
Guinea-Bissau	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Guyana										
Indonesia	3.56	2.78	2.94		2.59	0.04	0.03	0.03		0.02
Iran	2.98	3.27	4.11	4.38	5.14	0.09	0.09	0.10	0.10	0.11
Iraq					4.92					0.07
Jordan	3.31	3.32	3.31	3.32	5.73	0.09	0.07	0.06	0.05	0.08
Kazakhstan	5.36	5.01	5.02	5.26	5.30	0.88	0.86	0.91	0.94	0.85
Kuwait	0.00	0.00	0.00	0.00			0.00	0.00	0.00	
Kyrgyz Republic					2.17					0.07
Lebanon										
Libya	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Malaysia	5.08	5.08	4.94	5.04	6.85	0.09	0.08	0.07	0.06	0.08
Maldives	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Mali	0.53	0.53	0.60	0.60		0.07	0.07	0.07	0.06	
Mauritania				0.70	0.71				0.24	0.19
Morocco	4.24	4.27	4.27	4.27	4.73	0.08	0.07	0.07	0.06	0.06
Mozambique				3.90	3.96				0.15	0.12
Niger	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Nigeria	3.86	3.91	3.91	3.87	3.87	0.04	0.03	0.03	0.03	0.02
Oman	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Pakistan	11.38	11.38	10.11	10.11	10.11	0.08	0.07	0.06	0.05	0.04
Palestine										
Qatar	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Saudi Arabia	0.50	0.51	0.48	0.51	0.66	0.06	0.06	0.05	0.04	0.05
Senegal	4.71	4.71	4.71	4.71		0.12	0.10	0.09	0.08	
Sierra Leone										
Somalia		0.00	0.00	0.00		0.00	0.00	0.00	0.00	
Sudan	2.01	1.93	1.94	2.31	1.82	0.18	0.15	0.13	0.14	0.11
Suriname										
Syria	12.99	8.30	9.64	14.72	11.65	0.19	0.10	0.11	0.14	0.10
Tajikistan				4.40	4.44				0.09	0.08
Togo										
Tunisia	14.61	11.97	14.55	12.29	13.94	0.28	0.21	0.24	0.19	0.20
Turkey	10.95	11.11	11.27	11.30	12.53	0.15	0.14	0.13	0.12	0.13
Turkmenistan				5.38	6.63				0.52	0.60
Uganda	6.25	6.34	1.32	1.31		0.07	0.06	0.01	0.01	
United Arab Emirates										
Uzbekistan			8.57	9.44	9.85			0.15	0.15	0.14
Yemen	0.00	0.00	0.00	0.00			0.00	0.00	0.00	
OIC Countries	**3.08**	**2.88**	**3.04**	**3.13**	**4.24**	**0.09**	**0.07**	**0.07**	**0.08**	**0.07**
Other Developing Countries	**7.25**	**7.09**	**7.11**	**7.88**	**7.41**	**0.14**	**0.13**	**0.11**	**0.12**	**0.11**
Developed Countries	**17.16**	**28.41**	**19.08**	**21.53**	**16.66**	**0.50**	**0.45**	**0.45**	**0.52**	**0.49**
World	**8.30**	**8.71**	**8.10**	**9.35**	**9.36**	**0.19**	**0.19**	**0.16**	**0.18**	**0.16**

* 2007 or later.

Source: World Bank, World Development Indicators

Appendix 3: Air Network Density

Country	Departures per 1000 heads[1]					Passengers per 1000 heads[2]				
Name	**1995**	**2000**	**2005**	**2010**	**2014**	**1995**	**2000**	**2005**	**2010**	**2014**
Afghanistan	0.35	0.14		0.78	0.80	12	6		71	68
Albania	0.19	1.27	1.39	3.23	0.69	4	45	63	264	52
Algeria	1.66	1.32	1.39	1.47	1.53	123	98	92	94	120
Azerbaijan	2.55	1.00	1.49	1.09	1.92	150	68	135	88	186
Bahrain	23.20	32.77	44.65	49.53	40.64	1857	2127		4780	3797
Bangladesh	0.10	0.04	0.05	0.13	0.37	10	9	11	12	20
Benin	0.23	0.23	0.09	0.13	0.06	13	12		6	6
Brunei Darussalam	40.01	38.20	31.91	31.36	26.65	3106	2590	2641	3212	2606
Burkina Faso	0.31	0.29	0.11	0.27	0.21	14	12	5	10	7
Cameroon	0.27	0.35	0.60		0.25	25	17	22	0	12
Chad	0.28	0.18	0.07	0.06	0.01	13	9		4	2
Comoros	2.26	2.04				56				
Cote d'Ivoire	0.29	0.14	0.04	0.28	0.18	12	6		26	11
Djibouti	6.25									
Egypt	0.61	0.68	0.58	1.27	1.01	61	64	63	116	101
Gabon	11.07	6.04	6.21	4.87		469	362	340		
Gambia					0.96					
Guinea	0.09	0.07				5				
Guinea-Bissau	1.03	0.92				18				
Guyana	4.61	0.55	0.36	12.41	1.79	160	97		363	56
Indonesia	1.37	0.77	1.46	2.16	2.77	83	48	122	246	371
Iran	0.82	1.29	1.75	2.13	1.99	107	136	184	253	202
Iraq	0.01			0.25	0.12				21	14
Jordan	4.00	3.43	3.64	6.50	5.77	303	267	321	509	477
Kazakhstan	1.32	0.54	1.14	2.05	4.10	71	31	77	190	284
Kuwait	9.93	7.98	7.55	13.68	7.53	1083	965	960	1491	908
Kyrgyz Republic	2.53	1.23	1.02	1.35	2.98	96	49	44	69	122
Lebanon	3.12	2.77	2.94	4.58	5.08	221	214	264	437	523
Libya	1.20	1.16	2.25	5.57	5.23	129	112		467	428
Malaysia	8.65	7.27	6.87	10.75	14.67	749	712	795	1218	1590
Maldives	16.14	21.93	15.46			640	1157	280		
Mali	0.14	0.14	0.06	0.31		8	7			
Mauritania	2.03	1.44	0.58	1.77	1.02	100	71	46	146	68
Morocco	1.21	1.55	1.60	2.35	2.08	80	127	115	223	191
Mozambique	0.20	0.37	0.47	0.56	0.75	11	14	17	23	28
Niger	0.14	0.14	0.05		0.05	8	7			
Nigeria	0.06	0.10	0.07	0.39	0.37	5	4	5	26	24
Oman	7.23	9.29	12.17	11.16	11.25	669	882		1108	1193
Pakistan	0.57	0.46	0.31	0.38	0.26	44	38	34	39	30
Palestine										
Qatar	25.49	43.21	51.91	51.44	69.84	2040	4333	6823	7019	9864
Saudi Arabia	5.37	5.28	5.03	6.32	8.19	631	609	689	724	1035
Senegal	0.52	0.24	0.57		0.28	17	10	40		
Sierra Leone	0.05	0.05	0.03			4	4	3		
Somalia	0.14			0.28	0.33				17	24
Sudan	0.30	0.22	0.22	0.30	0.17	16	12	13	16	13
Suriname	5.97	4.64	9.71	3.72	6.81	371	498	631	414	470
Syria	0.61	0.85	0.88	0.61	0.24	39	45	65	56	21
Tajikistan	0.61	0.64	1.07	0.75	0.31	142	27	73	81	38
Togo	0.29	0.29	0.12	1.28	1.48	17	15		104	110
Tunisia	1.66	2.08	2.12	2.95	4.10	158	199	199	260	419
Turkey	1.28	1.80	2.05	5.11	9.52	127	183	238	632	1220
Turkmenistan	2.99	4.86	2.91	0.64	0.07	179	285	341	60	11
Uganda	0.04	0.01	0.01	0.19	0.18	5	2	2	5	4
United Arab Emirates	14.07	14.93	21.33	28.92	39.27	1460	2129		5396	8398
Uzbekistan	0.71	1.22	0.85	0.80	0.75	97	71	63	74	83
Yemen	0.32	0.80	0.82	0.87	0.61	24	46	52	65	64
OIC Countries	**1.03**	**0.97**	**1.15**	**1.78**	**2.23**	**86**	**86**	**108**	**286**	**398**
Other Developing Countries	**0.97**	**1.03**	**1.24**	**1.72**	**2.08**	**60**	**68**	**98**	**158**	**217**
Developed Countries	**14.84**	**18.15**	**18.93**	**18.78**	**18.13**	**1107**	**1405**	**1527**	**1516**	**1648**
World	**3.26**	**3.75**	**3.97**	**4.33**	**4.49**	**236**	**285**	**323**	**388**	**457**

[1] Domestic takeoffs and takeoffs abroad of air carriers registered in the country.

[2] Includes both domestic and international aircraft passengers of air carriers registered in the country.

Source: World Bank, World Development Indicators

Appendix 4: Container port throughput, TEU per 1000 heads

Country Name	2008	2009	2010	2011	2012	2013	2014
Afghanistan	LL	LL	LL	LL	LL	LL	LL
Albania	16	23	30	32	34	38	34
Algeria	6	7	8	8	8	9	9
Azerbaijan							
Bahrain	241	234	230	235	247	263	274
Bangladesh	7	8	9	9	9	10	10
Benin	33	30	33	34	36	38	39
Brunei Darussalam	237	221	253	263	278	296	307
Burkina Faso	LL	LL	LL	LL	LL	LL	LL
Cameroon	14	12	14	14	15	16	16
Chad	LL	LL	LL	LL	LL	LL	LL
Comoros							
Cote d'Ivoire	37	34	30	31	33	34	35
Djibouti	440	633	722	753	799	851	882
Egypt	77	78	82	92	95	94	98
Gabon	108	88	100	103	108	114	117
Gambia							
Guinea							
Guinea-Bissau							
Guyana							
Indonesia	31	30	35	37	39	45	47
Iran	28	30	35	36	67	64	66
Iraq							
Jordan	101	114	102	106	111	117	121
Kazakhstan							
Kuwait	355	296	324	324	329	338	340
Kyrgyz Republic	LL	LL	LL	LL	LL	LL	LL
Lebanon	210	238	219	236	199	249	266
Libya	29	26	29	31	59	69	73
Malaysia	592	576	650	705	719	718	760
Maldives	167	171	195	203	214	227	234
Mali	LL	LL	LL	LL	LL	LL	LL
Mauritania	17	18	18	19	20	21	21
Morocco	29	39	64	64	55	76	91
Mozambique	10	9	10	11	11	12	12
Niger	LL	LL	LL	LL	LL	LL	LL
Nigeria	0	1	1	5	5	6	6
Oman	1292	1364	1323	1132	1175	1006	855
Pakistan	12	12	13	13	13	14	14
Palestine							
Qatar	288	258	196	192	195	202	205
Saudi Arabia	174	162	189	198	223	223	205
Senegal	28	26	27	28	29	30	31
Sierra Leone							
Somalia							
Sudan					13	14	14
Suriname							
Syria	30	33	31	33	34	37	38
Tajikistan	LL	LL	LL	LL	LL	LL	LL
Togo							
Tunisia	41	40	44	46	49	53	55
Turkey	74	63	77	82	91	97	100
Turkmenistan							
Uganda	LL	LL	LL	LL	LL	LL	LL
United Arab Emirates	2139	1872	1822	2009	2024	2139	2300
Uzbekistan	LL	LL	LL	LL	LL	LL	LL
Yemen	35	28	28	29	31	32	33
OIC Countries	**57**	**56**	**62**	**66**	**71**	**74**	**77**
Non-OIC Developing	**56**	**51**	**60**	**65**	**69**	**72**	**76**
Developed Countries	**203**	**177**	**198**	**210**	**217**	**221**	**230**
Small island states	**1349**	**1081**	**981**	**1024**	**1039**	**1163**	**1173**
World	**82**	**74**	**84**	**90**	**95**	**98**	**101**

* LL: Landlocked, TEU (Twenty foot Equivalent Unit).
Source: UNCTAD and World Bank

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